IMPERIAL AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI.

19061

MGIPC—S4—III-1-93—22-8-45—5,000.

SCIENCE

NEW SERIES. VOLUME XCVIII

JULY-DECEMBER, 1943

19061

LANCASTER, PA.
THE SCIENCE PRESS
1943

THE SCIENCE PRESS PRINTING COMPANY
LANCASTER, PENNSYLVANIA

CONTENTS AND INDEX

NEW SERIES. VOL. XCVIII—JULY TO DECEMBER, 1943

THE NAMES OF CONTRIBUTORS ARE PRINTED IN SMALL CAPITALS

Abbott, C. E., Apparent Time Acceleration with Age, 407
Abstracting Journals, H. Kirby, 84
Academies: Sciences, Virginia, 57; E. C. L. Miller, 306; U.S.S.R., 357; P. Kolesnikov, 205, 231; National, Peiping, 212; National, Charles L. Mayer Award, 427; Oregon, 445; Alabama, 510; New York, 579
Acids: d-Amino Oxidase Activity, L. C. Clark, Jr., et al., 89; P-Aminobenzoic, and Tubercle Bacillus, R. L. Mayer, 203; Amino, K. A. Kuiken, et al., 266; A. A. Albanese and V. Irby, 286
Adrenal Cortical Secretion, T. F. Dougherty and A. White, 367
Agriculture, Tropical, Institute at Turrialba, R. W. Keith, 16; Department of, Research, T. S. Harding, 240
Air Transportation, W. H. Crew, 562
Aircraft: Engineering, 193; Standards, Canadian, 236; Production in Great Britain, 318; Heavier-Than-Air, Anniversary, 400; Tennyson's Prediction, M. F. Ashley Montagu, 431
Albanese, A. A., Methionine and Tryptophane-Free Casein Hydrolysates, 46; and V. Irby, Amino Acids, 286
Alcohol, Problems of, 556
Alden, W. C., Glacier National Park, 82
Alexander, H. L., et al., Teaching of Tropical Medicine, 39
Allard, H. A., North American Ragweeds, 292
American Association for the Advancement of Science: Science Mobilization Bill, 135; Lancaster Branch, 425; Pacific Division, 426
Anderson, H. W., Clavacin and the Press, 282
Anemia and Granulocytopenia in Rats Fed Sulfonamides, A. Kornberg, et al., 20
Angiotonin or Hypertensin, B. A. Houssay, et al., 495
Anigstein, L., et al., Spotted Fever Virus and Immune Serum, 285
Animas Valley, Drying Cracks, W. B. Lang, 583
Ansbacher, H. L., Military Psychology in Germany, 218
Anthropology, Recent, The Late F. Boas, 311, 334
Antibodies, Denatured, J. O. Erickson and H. Neurath, 284
Antigen-Antibody, Precipitation, L. Pauling, et al., 263
Aquarium of the Zoological Park, London, 102
Aqueous Solutions, Extraction of, B. S. Gould, 546
Archibald, Raymond C., Retirement of, 261
Argentina, Declaration of Citizens, 467
Aristotle, Newton, Einstein, E. T. Whitaker, 249, 267
Asmous, V. C., Russian Names, 450
Astronomical Problems of To-Day, J. Jeans, 373
Australopithecines, Life-Habits, L. C. Eiseley, 61
Auxin Action, J. Berger and G. S. Avery, Jr., 454
Avery, G. S., Jr., and J. Berger, Auxin Action, 454; Tryptophan and Phytohormone, 513
Awards, Prizes and Medals: Social Science Research Council, 34; Sigma Xi Grants-in-Aid of Research, 214; Mead Johnson and Company B-Complex Award, A. H. Smith, 237; Borden, in Nutrition, 380; National Academy of Sciences, Charles L. Mayer Award, 427; College of the City of New York Alumni Medal, 445; William H. Nichols Medal, 445; Sedgwick Memorial Medal, 505; Mechanical Engineers Awards, 510; Edison Medal, 580

Bacilli: Pigment and Tubercle, R. L. Mayer, 203; Tubercle, Toxic and Sensitizing Substance from, N. Choucroun, 327
Bacteria: Crown-gall, P. R. White, 199; Metabolism, F. Bernheim, 223; Growth and Propamidine, H. I. Kohn, 224
Bailey, I. W., Plant Tissue Culture, 539
Bancroft, W. D., Biochemistry of Anthocyanins, 98
Barbour, T., Marine Biological Laboratories, 141
Barometer, Invention of, Tercentenary, 1643–1943, 9, 402
Batschelet, C. E., and M. J. Proudfoot, Census Areas for the United States, 1940, 107
Beard, J. W., et al., Influenza Virus B (Lee Strain), 307; Swine Influenza Virus, 587
Berger, J., and G. S. Avery, Jr., Auxin Action, 454
Bernheim, F., Bacterial Metabolism, 223
Berry, W. E., The Giant Sequoia, 586
Biochemistry of Anthocyanins, W. D. Bancroft, 98
Biological Laboratories, Marine, T. Barbour, 141; Woods Hole, 257
Birth and Death Rates in Great Britain, 55, 192
Blood: Cell Volume and Hemoglobin, A. T. Shohl and L. K. Diamond, 22; Filter, 92, 570; Plasma and Berkefeld Candles, B. Witlin, 160; Plasma, Beef and Human, J. H. Lewis, 371
Boas, F., The Late, Recent Anthropology, 311, 334
Botanic Garden: Elgin, J. B. Langstaff, 40; University of Cambridge, 55
Botany, Viewpoints and Scientific Concepts, J. F. Stanfield, 164
Bouyoucos, G., and H. A. Cardinell, Dehydration, 435
Bowman, D. E., Digestion of Starch and Navy Beans, 308
Boyd, W. C., Editorial Changes in Scientific Papers, 197
Brandwein, P. F., et al., Chaos Chaos, 431
Browne, C. A., "Starring," American Men of Science, 281
Bryan, K., Geologists in War Service, 300
Buds, "Dormant" versus "Adventitious," E. L. Stone, Jr., and M. H. Stone, 62
Burkholder, P. R., Vitamins in Edible Soybeans, 188
Bush, V., Kilgore Bill, 571
Butter, Nutritive Value, H. J. Deuel, Jr., et al., 139

Cairns, W. D., et al., Mathematics Teachers, 257
Calomel Half Cell, F. L. Hahn, 140
Campbell, B., Loss of Proprioceptive Reflexes, 114
Canyons, Submarine, F. P. Shepard, 208
Capillary Fragility, Measuring, R. A. Waud and H. G. Skinner, 115
Cardiac Physiology, O. S. Gibbs, 584
Carlson, A. J., Apparent Time Acceleration with Age, 407
Carmichael, L., Scientific Men in War Work, 144
Carotene, Destruction of, E. L. Hove, 433
Carpenter, C. C., Riboflavin-Vitamin B_2 in Soil, 109
Carsner, E. and C. W. Bennett, Curly-Top Virus, 385
Cartography, Scale Curves in, E. Kasner and J. De Cicco, 324
Caspari, E., Tryptophane and Ephestia Kühniella Z., 478
Cell, Relative Volume, A. K. Parpart and R. Ballentine, 545
Cells, Concept of, E. B. Matzke, 13
Census: Areas for the United States, 1940, C. E. Batschelet and M. J. Proudfoot, 107; Bureau and the Great Lakes, C. S. and S. Osborn, 323
Cerebral Cortex and Ether, F. N. Craig, 68
Chaos Chaos, P. F. Brandwein, et al., 431
Chemicals: Industry, Manpower Problems, 148; Seed Treatments, K. S. Chester, 261; Rare, 103, 296, 380, 425, 509; Reagent, Preference Order for, 338
Chemists: Canadian, 443; Professional Training, 424
Chester, K. S., "Chemical" Seed Treatments, 261; Russian Names, 302
Chick, Cells, Embryonic, Mitoses, E. F. Stilwell, 264; Utilization of Dl-Alpha-Tocopherol, H. Patrick and C. L. Morgan, 434

China: Advancement of Science, C. H. Liu, 47; Men of Science, Message from, 102; Visiting Professor to, 320
Cholinesterase, B. Mendel and H. Rudney, 201; M. W. de Laubenfels, 450
Choucroun, N., Toxic and Sensitizing Substance from Tubercle Bacilli, 327
Clark, L. C., Jr., *et al.*, d-Amino Acid Oxidase Activity in the Mouse, 89
Clavacin and the Press, H. W. Anderson, 282
Clifton, C. E., Production of Penicillin, 69
Climatology, Research Committee, H. D. Harradon, 170
Coagulum-Contact Technic, M. E. Sano and C. A. Holland, 524
Cole, H. H. and S. W. Mead, Ration of Ruminants, 543
Color: Reaction for Detection of Uracil and Cytosine, T. B. Johnson, 90; Mixer, W. F. Grether, 248; Vision and Mental Maladjustment, K. Dunlap, 470
Compton, K. T., Organization of Scientists for War, 71, 93
Conifer Embryos in Vitro, S. W. Loo and F. H. Wang, 544
Correction, M. Heidelberger and C. F. C. MacPherson, 63
Corticotropin, R. Tyslowitz, 225
Cotton Boll-Shedding, A. A. Dunlap, 568
Craig, F. N., Cerebral Cortex and Ether, 68
Creative Years, Man's, H. C. Lehman, 393
Crew, W. H., Air Transportation, 562
Cytological Techniques, N. W. Stuart and S. L. Emsweller, 569

Dalldorf, G. and E. Whitney, Experimental Poliomyelitis, 477
Darrow, K. K., Internationalism in Science, 122
Death and Birth Rates in Great Britain, 55, 192; in Germany, 126
DeFalco, R. J., *et al.*, Antigenicity of Protein, 542
Dehydration, G. Bouyoucos and H. A. Cardinell, 435
de Laubenfels, M. W., Cholinesterase, 450
Desthiobiotin, V. du Vigneaud, *et al.*, 497
Deuel, H. J., Jr., *et al.*, Nutritive Value of Butter, 139
Diasone, G. W. Raiziss, 350
Diet of Chinese Soldiers and Students, T. Shen, 302
Digestion of Living Tissue, C. A. Dragstedt, 131
Dondlinger, P. T., Apparent Time Acceleration with Age, 300
Donnelly, M., Vitamin C in Evergreen-tree Needles, 132
Dougherty, T. F. and A. White, Adrenal Cortical Secretion, 367
Dragstedt, C. A., Digestion of Living Tissues, 131
Drift, Continental, J. R. Peters, 60
Driver, R. L., *et al.*, Permeability of the Mucosa on the Formation of Ulcers, 158
Duncan, D., Spinal Nerves, 515
Dunham, W. B., Vitamin C from Evergreens, 325
Dunlap, A. A., Cotton Boll-Shedding, 568
Dunlap, K., Mental Maladjustment and Color Vision, 470
du Vigneaud, V., *et al.*, Desthiobiotin, 497
Dysentery Registry, 425

Ecker, E. E., *et al.*, Human Complement, 43
Eiseley, L. C., Life-Habits of the Australopithecines, 61
Electron Microscopy, H. C. O'Brien and G. M. McKinley, 455
Ellsworth, E. W., Transparencies of Tropical Plants, 199
Emotions and Gastric Function: H. G. Wolff, 481
Engineering, Aircraft, 193
Ennis, W. D., Apparent Time Acceleration with Age, 301
Epling, G., Taxonomy and Genonomy, 515
Erickson, J. O., and H. Neurath, Denatured Antibodies, 284
Escuela Agricola Panamericana, W. Popenoe, 275
Evans, C. A., *et al.*, Intra-Ocular Virus Infections, 45

Fats and Oils, Nutritive Value of, E. B. Hart, *et al.*, 499
Fellowships: Guggenheim, 33, 339; Medical, of the National Research Council, 35; Lewis Cass Ledyard, Jr., 236
Filter, Blood and Plasma, S. B. Rose, 92; E. B. Glaser, 570
Fink, C. G., Initiative in Research, 28
Fisheries Research in Canada, A. G. Huntsman, 117
Flocculation Test, I. A. Mirsky and R. von Brecht, 499
Floras, New, 319
Flour, Enrichment of, 32
Foley, G. E., Hemolytic Streptococci with Erythrogenic Toxin, 370
Forest Products Laboratory, 489
Forestry Policy of Great Britain, 555
Foster, R. W., "Starring," 474
Foundations: Infantile Paralysis, 8, 128; for Tropical Medicine, 193; Nutrition, 237; Johnson and Johnson, Grants to the National Research Council, 339; Wellcome, Director of Research, 358; Finney-Howell Research, 380; Nutrition, 444; Sugar Research, 509; Dr. William Beaumont, 533
Francis, A. W., Running Records, 315
Franklin Institute, Planetarium and Museum, 403
Frear, D. E. H., Catalogue of Insecticides and Fungicides, 585
Fried, S., *et al.*, Determination of Propylene and Triethylene Glycol, 479
Frolich, P. K., Petroleum, 457, 484
Fromm, F., Growth Stimulation, 391
Fund, Louis Livingston Seaman, 277
Furfey, P. H., Transliteration of Russian Names, 153
Furth, J., and M. C. Boon, Methylcholanthrene and X-Rays, 138

Gastric Function and Emotions, H. G. Wolff, 481
Geography, Department of, 564
Geological, Survey, Director, 80; Texts for South America, W. D. Smith, 496
Geologists in War Service, K. Bryan, 300
Geology, Personnel Problems, 402; Texts for Latin America, H. E. Stocking, 198
Germicides, Study of, 128
Gibbs, O. S., Cardiac Physiology, 584
Gifts to the Royal College of Surgeons, England, 424
Glacial Lake Spokane, T. Large, 560
Glacier, Pleistocene Continental, W. H. Hobbs, 227
Glaser, E. B., Nylon Blood and Plasma Filter, 570
Glockler, G., American Learning When Peace Comes, 525
Glycol, Propylene and Triethylene, Determination of, S. Fried, *et al.*, 479
Glyoxal in Histological Fixations, L. F. Wicks and V. Suntzeff, 204
Goldberg, L., Sodium Iodoacetate, 386
Goldstein, D. H., *et al.*, Toxicity of Mapharsen in Rabbits, 245
Gould, B. S., Extraction of Aqueous Solutions, 546
Gouley, R. W., Automatic Flow Switch, 330
Govier, W. M., and M. E. Greig, B_1 Avitaminotic Dogs, 216
Grants: to the University of Wisconsin, 103; Research in Applied Psychology, 236; and Gifts to the University of Illinois, 255; to the National Research Council from the Johnson and Johnson Research Foundation, 339
Great Britain: King's Birthday Honors, 8; Royal Society, Foreign Members, 34; Vital Statistics, 55, 192, 465; London Zoological Park and Aquarium, 102; Industrial Research in, 146; Standards Institution, 170; University of London, 212; Scientific Research in, 235; Visit of Surgeons to the U.S.S.R., 295; Aircraft Production, 318; Gifts to the Royal College of Surgeons, England, 424; Royal Society Medalists, 491; Scientific and Technological Training, 532; Forestry Policy of, 555
Grether, W. F., Three-Color Mixer, 248
Group Concept, G. A. Miller, 362
Growth Stimulation, F. Fromm, 391

Gunderson, F. L., Water-Soluble Vitamins, 277
György, P., *et al.*, Rancidity and Sulfhydryl, 518

Haensel, V., and V. N. Ipatieff, Triptane Process, 495
Hahn, F. L., Calomel Half Cell, 140
Hahn, P. F., Alimentary Lipemia and Heparin, 19
Hall, E. R., U. S. Text-books for Latin American Universities, 15
Hanzlik, P. J., and W. C. Cutting, Sulfonamide Depression of Inorganic Catalytic Action, 389
Harding, T. S., Research by Department of Agriculture, 240
Hardt, C. R., *et al.*, Heat Coagulation of Bovine Plasma Glucose, 309
Harradon, H. D., Research Committee on Climatology, 170
Harrington, J. P., Language, American Indian, 325
Harriss, R. P., Apparent Time Acceleration with Age, 408
Hart, E. B., *et al.*, Nutritive Value of Fats and Oils, 499
Hartman, C. G., Rhesus Monkey, 449
Health Service, Public, 556
Heat and Thermodynamics, Letter Symbols for, S. A. Moss, 343
Heidelberger, M., and C. F. C. MacPherson, Correction, 63
Hen, Heath, J. H. Pannell, 174
Henderson, Y., A Street Corner Pump, 25; The Pulmotor, 547
Henle, W. and G., Virus of Influenza, 87
Herbarium, Berlin, Destruction of, 490
Hilleman, M. R., and F. B. Gordon, Mouse Pneumonitis Virus, 347
Histological Fixations and Glyoxal, L. F. Wicks and V. Suntzeff, 204
Hobbs, W. H., Growth of an Ice Sheet, 217; Pleistocene Continental Glacier, 227
Horsfall, F. L., Jr., *et al.*, Atypical Pneumonia, 566
Hospital Units for Civilian Defense, 169
Houssay, B. A., *et al.*, Angiotonin or Hypertensin, 495
Hove, E. L., Destruction of Carotene, 433
Hrdlička, A., English Names in Russian, 219
Hulpieu, H. R., Gravity Writing Lever, 116
Human Complement, E. E. Ecker, *et al.*, 43
Huntsman, A. G., Fisheries Research in Canada, 117
Hutchins, R. M., Values of the Museum, 331
Hydrographic Work, J. W. Wells, 562
Hydrolysates, Methionine and Tryptophane-Free Casein, A. A. Albanese, 46
Hydrolysis of d-Peptides, G. E. Pickford, 14

Ice Sheet, Growth of, W. H. Hobbs, 217
Illustrations, Numbering, A. K. Kurtz and J. W. Dunlap, 174
Influenza: Virus of, 87; A, Isolation of, M. Thigpen and J. Crowley, 516
Insect Flight, C. M. Williams and L. E. Chadwick, 522
Insecticides and Fungicides, Catalogue, D. E. H. Frear, 585
Instruments, New and Rare, 57, 257
Insulin Action, J. Sacks, 388
Isotel, Isotelic, R. J. Williams, 386

Jeans, J., Astronomical Problems of To-Day, 373
Johnson, T. B., Color Reaction for Detection of Uracil and Cytosine, 90
Jones, G. N., Giant Sequoia, 406

Kabat, H., *et al.*, Poliomyelitis, 589
Karpinski, L. C., National Learned Society Groups, 175
Kasner, E., and J. De Cicco, Scale Curves in Cartography, 324
Keith, R. W., Institute of Tropical Agriculture at Turrialba, 16
Keys, D. A., Royal Society of Canada, 178
Kilgore Bill, 135, 213; H. M. Kilgore, 151; H. T. Stetson, 364; L. H. Taylor, 472; V. Bush, 571
Kilgore, H. M., The Science Mobilization Bill, 151
Kirby, H., Abstracting Journals, 84
Klotz, I. M., Acidity and Activity of Sulfonamides, 62
Kohn, H. I., Bacterial Growth and Propanidine, 224
Kolesnikov, P., Academy of Sciences of the U.S.S.R., 205, 231
Kornberg, A., *et al.*, Granulocytopenia and Anemia in Rats Fed Sulfonamides, 20
Krotkov, V., Transliteration of English Names into Russian, 344
Kuiken, K. A., *et al.*, Amino Acids, 266
Kupperman, H. S., and C. R. Noback, Iron Hematoxylin Tissue, 591
Kurtz, A. K., and J. W. Dunlap, Numbering Illustrations, 174

Laboratory Equipment, 401; Preference Limitation Order, 104
Lang, W. B., Mosses of Luray Cavern, 173; Animas Valley Drying Cracks, 583
Langstaff, J. B., Elgin Botanic Garden, 40
Language, American Indian, J. P. Harrington, 325; Origin of, E. L. Thorndike, 1
Large, T., Glacial Lake Spokane, 560
Lawrence, C. A., Sterility Test for Penicillin, 413
Learning, American, When Peace Comes, G. Glockler, 525
Lecturers, United States, in Brazil, 127
Lehman, H. C., Longevity of the Eminent, 270; Man's Creative Years, 393
Lennette, E. H., Recent Advances in Viruses, 415
Lettuce Seed, Germination of, G. J. Raleigh, 538
Leukemia and Adrenals of Rats, J. B. Murphy and E. Sturm, 568
Lewis, J. H., Deantigenated Beef Blood Plasma, 371
Library, of Sir Isaac Newton, 128; The Hooker Scientific, 465
Liming, O. N., Descriptive Words, 539
Limitation Order L-144, War Production Board, 358
Lipemia, Alimentary, and Heparin, P. F. Hahn, 19
Lipmann, F., and C. R. Owen, Enzymatic Xanthine Oxidation, 246
Liu, C. H., Advancement of Science in China, 47
Longevity of the Eminent, H. C. Lehman, 270
Loo, S. W., and F. H. Wang, Conifer Embryos in Vitro, 544

McClung, L. S., Staining of Yeast Spores, 159
Macnamara, C., Vitamin C in Evergreen-Tree Needles, 242
Mapharsen, Toxicity of, D. H. Goldstein, *et al.*, 245
Maple Syrup and Grazing, P. B. Sears, 83
Maps: Population and Physiographic, of Missouri, C. B. Odell, 476; Pacific, 489; World, of the National Geographic Magazine, 533
Marsland, D. A., Quieting Paramecium, 414
Mathematical Advances, G. A. Miller, 38
Mathematics, Collegiate, Teachers of, W. D. Cairns, *et al.*, 257
Matzke, E. B., Concept of Cells, 13
Mayer, R. L., Pigment and Tubercle Bacillus, 203
Medical: Fellowships, of the National Research Council, 35; Survey of Colleges, 401; School, Army, Fifth Anniversary, 579
Medically Indigent, Care of, 56
Medicine, Tropical, Teaching of, H. L. Alexander, *et al.*, 39; Industrial, Post Graduate Course, 193; Tropical, American Foundation for, 193
Mellon Institute Lectures, 358
Mendel, B., and H. Rudney, Cholinesterase, 201
Metal Congress, National, 79, 276
Methylcholanthrene and X-Rays, J. Furth and M. C. Boon, 138
Michaelis, M., *et al.*, Normal and Tumor Tissue in Beet Roots, 89

Microbiology and Visual Instruction, 213
Microscopes, Dissecting, Light for, R. L. Patton, 392; Electron, H. C. O'Brien and G. M. McKinley, 455
Miller, E. C. L., Virginia Academy of Science, 306
Miller, G. A., The Group Concept, 362; Mathematical Advances, 38
Mineral Deposits, J. J. Wolford, 261
Mirsky, I. A., and R. von Brecht, Flocculation Test, 499
Mixer, Three-Color, W. F. Grether, 248
Mobilization Bill, Science, 135, 235; H. M. Kilgore, 151; H. T. Stetson, 364; L. H. Taylor, 472; V. Bush, 571
Monkey, Rhesus, C. G. Hartman, 449
Montagu, M. F. Ashley, Tennyson's Prediction Concerning the Aeroplane, 431
Moss, S. A., Letter Symbols for Heat and Thermodynamics, 343
Mosses of Luray Cavern, W. B. Lang, 173
Murneek, A. E., and S. H. Wittwer, Plant Development, 384
Murphy, J. B., and E. Sturm, Adrenals and Leukemia of Rats, 568
Muscle, Fibers, Live Rat, W. S. Wilde, 202; Biopsy, R. E. Shank and C. L. Hoagland, 592
Museum: Field, of Natural History, 237, 256, 276; Royal College of Surgeons, Restoration, 296; Value of, R. M. Hutchins, 331; Franklin Institute, Anniversary of Planetarium and Museum, 403
Myasthenia Gravis, C. Torda and H. G. Wolff, 224

National: Foundation for Infantile Paralysis, 8, 128; Learned Society Groups, L. C. Karpinski, 175; Metal Congress, 79, 276; Research Council, Informational Service, 491, Medical Fellowships, 35
Nature, Saving, for Scientific Purposes, V. E. Shelford, 280
Naval Laboratory Research Unit No. 1, Protection Against Influenza Virus, 348
Nerves, Spinal, D. Duncan, 515
Newton, Sir Isaac, Library of, 128
Nichols, D. G., Transliteration of Russian Names, 132
Nitardy, F. W., Apparent Time Acceleration with Age, 110
Nutrition, Borden Award in, 380; Foundation, 444
Nutritive Value of Butter, H. J. Deuel, Jr., *et al.*, 139; of Fats and Oils, E. B. Hart, *et al.*, 499

Obituaries: Abbe, Cleveland, E. I. Yowell, 553; Aguilar, Felix, O. Struve, 423; Ames, Joseph Sweetman, L. J. Briggs, 100; Ball, Elmer Darwin, C. T. Vorhies, 506; Barbour, H. G., W. T. Salter, 442; Barker, Lewellys F., W. T. Longcope, 316; Bayley, William Shirley, M. M. Leighton, 145; Burks, Barbara Stoddard, K. S. Brehme, 463; Cady, Hamilton Perkins, R. Q. Brewster, 190; Doane, Rennie Wilbur, J. M. Miller, 273; Ets, Harold Norris, H. A. McGuigan, 191; Gager, C. Stuart, W. J. Robbins, 234; Goodspeed, Arthur Willis, O. Glasser, 219; H. C. Richards, 125; Graves, George West, L. F. Hadsall, 531; Henrici, Arthur Trautwein, W. P. Larson, 77; Hrdlička, Aleš, W. M. Krogman, 254; Landsteiner, Karl, M. Heidelberger, 233; Locke, Leslie Leland, L. C. Karpinski, 274; McCourt, Walter E., L. F. Thomas, 167; Macfarlane, John Muirhead, W. Steckbeck, 487; McGiffert, James, H. S. van Klooster, 294; Magie, William Francis, E. P. Adams, 31; Marvin, Charles Frederick, W. J. Humphreys, 6; Mitchel, Ormsby MacKnight, E. I. Yowell, 553; Morrill, Albro D., W. N. Hess, 210; Platt, Elizabeth Towar, R. H. Brown, 210; Osgood, William Fogg, J. L. Coolidge, *et al.*, 399; Schlesinger, Frank, H. N. Russell, 123; Snyder, John Otterbein, W. H. Rich, 356; Stejneger, Leonhard, P. Bartsch, 51; Taussig, Frederick Joseph, E. V. Cowdry, 464; Van Vleck, Edward Burr, R. E. Langer, 530; Webster, L. T., J. Casals and T. M. Rivers, 167; White, Henry Seely, M. E. Wells, 76
O'Brien and G. M. McKinley, Electron Microscopy, 455

Observatory, Cincinnati, Centennial, 359; R. Walters, 551
Oceanarium at Coney Island, 127
Odell, C. B., Population and Physiographic Maps of Missouri, 476
Orchid Seeds, R. D. Svihla and E. Osterman, 23
Ornithologists' Union, American, 466
Osborn, C. S., and S. Osborn, Census Bureau and the Great Lakes Area, 323
Oxidation, Enzymatic Xanthine, F. Lipmann and C. R. Owen, 246

Page, I. H., *et al.*, Designation of "Renin-Activator" to Renin-Substrate, 153
Pannell, J. H., Heath Hen, 174
Paralysis, Infantile, Work of National Foundation, 128
Paramecium, Quieting, D. A. Marsland, 414
Parasite, Protozoan, of Quail Malaria, R. L. Patton and R. L. Metcalf, 184
Parks: Glacier National, W. C. Alden, 82; London Zoological, 102
Parpart, A. K., and R. Ballentine, Relative Cell Volume, 545
Patrick, H., and C. L. Morgan, Utilization of Dl-Alpha-Tocopherol by the Chick, 434
Patton, R. L., Light for Dissecting Microscopes, 392; and R. L. Metcalf, Protozoan Parasite of Quail Malaria, 184
Pauling, L., Antigen-Antibody Precipitation, 263
Penicillin: 192; Inoculated, Dressing, G. H. Robinson and J. E. Wallace, 329; Production of, C. E. Clifton, 69; Test for Sterility, C. A. Lawrence, 413
Percentage Counts, F. M. Wadley, 536
Peters, J. L., International Commission on Zoological Nomenclature, 9
Peters, J. R., Continental Drift, 60
Petroleum, P. K. Frolich, 457, 484
Pharmaceutical Manufacturers' Association, American, 533
Physics, American Institute of, 296; War Policy Committee, 147
Pickford, G. E., Hydrolysis of d-Peptides, 14
Pituitary of the Rat, M. Reed, 500
Plants: Tropical, Transparencies of, E. W. Ellsworth, 199; Performance and Night Temperature, R. H. Roberts, 265; Development, A. E. Murneek and S. H. Wittwer, 384; Tissue Culture, I. W. Bailey, 539
Plasma, Bovine, Heat Coagulation and Glucose, C. R. Hardt, *et al.*, 309
Pneumonia: Atypical, H. M. Rose and E. Molloy, 112; F. L. Horsfall, Jr., *et al.*, 566; Atypical Primary, D. H. Vance, *et al.*, 412
Poliomyelitis, H. Karat, *et al.*, 589; Virus, R. W. Schlesinger, *et al.*, 452; Experimental, G. Dalldorf and E. Whitney, 477
Popenoe, W., Escuela Agricola Panamericana, 275
Potash in Texas and New Mexico Permian, A. F. Woods, 260
Potzger, J. E., and B. C. Tharp, Canadian Spruce and Fir Pollen in Texas, 584
Protein, Antigenicity of, R. J. DeFalco, *et al.*, 542; Concentrates from Grasses, J. T. Sullivan, 363
Psychology, Military, in Germany, H. L. Ansbacher, 218
Pulmotor, Y. Henderson, 547
Pump, Street Corner, Y. Henderson, 25

Radio Engineers Institute, 579
Ragweeds, North American, H. A. Allard, 292
Raiziss, G. W., Diasone, 350
Raleigh, G. J., Germination of Lettuce Seed, 538
Rancidity and Sulfhydryl, P. György, *et al.*, 518
Rat, Livers, Estrogen in Vitro, J. Schiller and G. Pincus, 410; Pituitary of, M. Reed, 500
Rationing, 379
Rats, Leukemia and the Adrenals, J. B. Murphy and E. Sturm, 568

RAY, C. N., Texas Skeleton, 344
Records, Running, A. W. FRANCIS, 315
REED, M., Pituitary of the Rat, 500
Reflexes, Proprioceptive, Loss of, B. CAMPBELL, 114
Rehabilitation Clinics, 319
"Renin-Activator," to Renin-Substrate, Designation of, I. H. PAGE, *et al.*, 153
Research, Initiative in, C. G. FINK, 28; Council, Social Science, Awards, 34; Council, National, Medical Fellowships, 35; Endowment of, Virginia Academy of Science, 55; in the United States, 78; Fisheries, in Canada, A. G. HUNTSMAN, 117; in Great Britain, 146; Office of Scientific Research and Development, 148, 235; and Therapeutics: A. E. SMITH, 161; Committee on Climatology, H. D. HARRADON, 170; Sigma Xi, Grants-in-Aid, 214; Pooling, 219; Grants in Applied Psychology, 236; Department of Agriculture, T. S. HARDING, 240; Ophthalmological, at the University of Oxford, 318; National, Council, Grants from Johnson and Johnson Foundation, 339; Director of Wellcome Foundation, 358; Finney-Howell Foundation, 380; National, Council, Informational Service, 491; Council, National, Grants in Endocrinology, 557
Resources: Planning Project, North Pacific, 275; Natural, and Warfare, H. B. WARD, 289
Reviews: 17, 18, 40, 42, 63, 65, 85, 86, 87, 110, 111, 112, 133, 134, 154, 155, 175, 176, 177, 199, 200, 201, 220, 221, 242, 243, 244, 262, 283, 284, 304, 305, 325, 345, 346, 365, 366, 367, 387, 409, 432, 450, 474, 476, 496, 497, 516, 518, 540, 541, 563
Riboflavin Deficiency, T. D. SPIES, 369
RICE, E. E., *et al.*, Thiamin in Dehydrated Pork, 449
ROBERTS, R. H., Night Temperature and Plant Performance, 265
ROBINSON, G. H., and J. E. WALLACE, Inoculated Penicillin Dressing, 329
ROSE, H. M., and E. MOLLOY, Atypical Pneumonia, 112
ROSE, S. B., A Nylon Blood and Plasma Filter, 92
ROUNSEFELL, G. A., Salmon Conservation, 152
Rubber from Russian Dandelions, 532
RUDOLPH, B. A., Walnut Erinose Mite and Blight, 430
Ruminants, Ration of, H. H. COLE and S. W. MEAD, 543
Russian Names, Transliteration, D. G. NICHOLS, 132; R. M. STRONG, 133; P. H. FURFEY, 153; A. HRDLIČKA, 219; K. S. CHESTER, 302; V. KROTKOV, 344; V. C. ASMOUS, 450

SABROSKY, C. W., Dates of Publication of Scientific Papers, 473
SACKS, J., Insulin Action, 388
Salmon Conservation, G. A. ROUNSEFELL, 152
SANO, M. E., and C. A. HOLLAND, Coagulum-Contact Technic, 524
SARNOFF, D., Industrial Science, 437
SCHICK, B., Scurvy and Pine Needles, 241
SCHILLER, J., and G. PINCUS, Rat Livers, 410
SCHLESINGER, R. W., *et al.*, Poliomyelitis Virus, 452
SCHMITT, W. L., Cause of "Red Water," 39
Science: Advancement of, in China, C. H. LIU, 47; and Society, 84; Internationalism in, K. K. DARROW, 122; Mobilization Bill, 135, 151, 213, 364, 472, 571; New Words in, H. WARD, 174; Talent Search, 256; American Men of Science, C. A. BROWNE, 281; F. C. WHITMORE, 473; R. W. FOSTER, 474; and Natural Resources, H. B. WARD, 289; and Industry, 303; in China, C. Y. WANG, 376; Industrial, D. SARNOFF, 437; Conferences on Philosophy and, 444; History of, Society, 466
Scientific: Men in War Work, L. CARMICHAEL, 144; Research and Development, Office of, 148; Concepts of Botany, J. F. STANFIELD, 164; Papers, Editorial Changes in, W. C. BOYD, 197; Congress, American-Soviet, 359; Societies in China, 380; Library, Hooker, 465; Papers, Dates of Publication, C. W. SABROSKY, 473; and Technological Training in Great Britain, 532
Scientists, Organization for War, K. T. COMPTON, 71, 93
Scurvy and Pine Needles, B. SCHICK, 241
SEARS, P. B., Maple Syrup and Grazing, 83
Seed Treatments, "Chemical," K. S. CHESTER, 261
Sequoia, Giant, G. N. JONES, 406; E. W. BERRY, 586
SHANK, R. E., and C. L. HOAGLAND, Biopsy of Muscle, 592
SHELFORD, V. E., Saving Nature for Scientific Purposes, 280
SHEN, T., Diet of Chinese Soldiers and Students, 302
SHEPARD, F. P., Submarine Canyons, 208
SHOHL, A. T., and L. K. DIAMOND, Cell Volume and Hemoglobin in a Drop of Blood, 22
Skeleton, Texas, C. N. RAY, 344
SMITH, A. E., Research and Therapeutics, 161
SMITH, S. G., *et al.*, Vitamin B_6, 520
SMITH, W. D., Geological Texts for South America, 496
Societies and Associations: Chemical, American, Pittsburgh Meeting, 10, 213, Officers, 580; Royal, London, Foreign Members, 34, Medalists, 491; American Mathematical, 104; Chemical Industry, 381, 104; American Public Health, Wartime Conference, 147; University Professors of the Allied Countries, 169; National Learned Society Groups, 175; Royal, Canada, D. A. KEYS, 178; Wildlife, W. P. TAYLOR, 185; Cereal Chemists and the Kilgore Bill, 213; Society of New York Hospital Fellowship, 236; American Philosophical, 320, 426; China, Scientific, 380; History of Science, 466; Mechanical Engineers, 466; Awards, 510; Entomological, 491, 578; Pharmaceutical Manufacturers' Association, 533; Tropical Medicine, American, 578
Society and Science, 84
Sodium Iodoacetate, L. GOLDBERG, 386
Soviet-American Conference, 403
SPIES, T. D., Riboflavin Deficiency, 369
SPINK, W. W., and J. J. VIVINO, Pigment Production and Sulfonamides, 44
Spruce and Fir, Canadian, Pollen in Texas, 584
Stain, Iron Hematoxylin Tissue, H. S. KUPPERMAN and C. R. NOBACK, 591
STANFIELD, J. F., Viewpoints and Scientific Concepts in Botany, 164
Starch, Digestion of, and Navy Beans, D. E. BOWMAN, 308
"Starring," C. A. BROWN, 281; R. W. FOSTER, 474; F. C. WHITMORE, 474
STETSON, H. T., Kilgore Bill, 364
STILWELL, E. F., Mitoses in Embryonic Chick Cells, 264
STIMMEL, B. F., Urinary Sex Hormone Residues, 480
STOCKING, H. E., Geology Texts for Latin America, 198
STONE, E. L., JR., and M. H. STONE, "Dormant" versus "Adventitious" Buds, 62
Streptococci, Hemolytic with Erythrogenic Toxin, G. E. FOLEY, 370
STRONG, R. M., Transliteration of Russian Names, 133
STUART, N. W., and S. L. EMSWELLER, Cytological Techniques, 569
Sulfhydryl and Rancidity, P. GYÖRGY, *et al.*, 518
Sulfonamides: Anemia and Granulocytopenia in Rats on, A. KORNBERG, *et al.*, 20; and Pigment Production, W. W. SPINK and J. J. VIVINO, 44; Acidity and Activity of, I. M. KLOTZ, 62; in the Tissues, M. B. SULZBERGER, *et al.*, 66; Depression of Inorganic Catalytic Action, P. J. HANZLIK and W. C. CUTTING, 389
SULLIVAN, J. T., Protein Concentrates from Grasses, 363
SULZBERGER, M. B., Sulfonamides in the Tissues, 66
SVIHLA, R. D., and E. OSTERMAN, Orchid Seeds, 23
Switch, Automatic Flow, R. W. GOULEY, 330
Symbols, Letter, for Heat and Thermodynamics, S. A. MOSS, 343

Taxonomy and Genonomy, G. EPLING, 515
TAYLOR, L. H., Science Mobilization Bill, 472
TAYLOR, W. P., Wildlife Society, 185
Text-books, U. S., for Latin American Universities, E. R. HALL, 15
Thiamin in Dehydrated Pork, E. E. RICE, *et al.*, 449
THIGPEN, M., and J. CROWLEY, Isolation of Influenza A, 516

Thorndike, E. L., Origin of Language, 1
Thyrotoxicosis, Treatment of, R. H. Williams and G. W. Bissell, 156
Time, Apparent Acceleration with Age, F. W. Nitardy, 110; P. T. Dondlinger, 300; W. D. Ennis, 301; F. Wilen, 301; C. E. Abbott, 407; A. J. Carlson, 407; R. P. Harriss, 408
Timing Device for Speakers, N. A. Weber, 116
Tissues, Living, Digestion of, C. A. Dragstedt, 131
Torda, C., and H. G. Wolff, Myasthenia Gravis, 224
Trask, P. D., Mexican Volcano Paricutin, 501
Triptane Process, V. Haensel and V. N. Ipatieff, 495
Tropical Hygiene, Ross Institute, 168
Tryptophan and Phytohormone, G. S. Avery, Jr. and J. Berger, 513
Tryptophane and Ephestia Kühniella Z, E. Caspari, 478
Tumor and Normal Tissue in Beet Roots, M. Michaelis, *et al.*, 89
Tyslowitz, R., Corticotropin, 225

Ulcers, Permeability of the Mucosa on the Formation of, R. L. Driver, *et al.*, 158
Universities and Colleges: Text-books for Latin America, E. R. Hall, 15; Mathematics Teachers, W. D. Cairns, *et al.*, 257; Medical Colleges, 401; Cambridge, Botanic Garden, 55; Cincinnati, Observatory, 359; Illinois, Gifts and Grants, 255; Illinois, Finances of, 532; London, 212; Oxford, Ophthalmological Research, 318; Gifts to the Royal College of Surgeons, England, 424; Wayne University, Development of, 508; Wisconsin, Gifts and Grants to, 103; Budget, 168
Urinary Sex Hormone Residues, B. F. Stimmel, 480

Vance, D. H., *et al.*, Atypical Primary Pneumonia, 412
Variants of the Rh Type, A. S. Wiener, 182
Vesalius Andreas, 557
Virginia, Resources, 102
Virus: Intra-Ocular, Infections, C. A. Evans, *et al.*, 45; Influenza, W. and G. Henle, 87; Spotted Fever and Immune Serum, L. Anigstein, *et al.*, 285; Influenza, B (Lee Strain), J. W. Beard, *et al.*, 307; Mouse Pneumonitis, M. R. Hilleman and F. B. Gordon, 347; Influenza, Protection Against, Naval Laboratory Research Unit No. 1, 348; Curly-Top, E. Carsner and C. W. Bennett, 385; Poliomyelitis, R. W. Schlesinger, *et al.*, 452; Recent Advances in, E. H. Lennette, 415; Influenza, Isolation, M. Thiopen and J. Crowley, 516; Swine Influenza, J. W. Beard, *et al.*, 587
Vitamins: Desthiobiotin, V. du Vigneaud, *et al.*, 497; B_1 Avitaminotic Dogs, W. M. Govier and M. E. Greig, 216; Riboflavin-Vitamin B_2 in Soil, C. C. Carpenter, 109; Riboflavin Deficiency, T. D. Spies, 369; B_6, S. G. Smith, *et al.*, 520; C from Evergreens, M. Donnelly, 132; W. B. Dunham, 325; C in Evergreen-Tree Needles, C. Macnamara, 242; D Patents, 78; in Edible Soybeans, P. R. Burkholder, 188; Water-Soluble, F. L. Gunderson, 277
Volcano, Parícutin, Mexican, P. D. Trask, 501

Wadia, D. N., Minerals in the War, 351
Wadley, F. M., Percentage Counts, 536
Walnut Erinose Mite and Blight, B. A. Rudolph, 430
Walters, R., Centenary of the Cincinnati Observatory, 551
Wang, C. Y., Science in China, 376
War: Organization of Scientists, K. T. Compton, 71, 93; American Institute of Physics, Policy Committee, 147; Conference of the American Public Health Association, 147; and Natural Resources, H. B. Ward, 289; Service of Geologists in, K. Bryan, 300; Minerals in, D. N. Wadia, 351
Ward, H., New Words in Science, 174
Ward, H. B., Warfare and Natural Resources, 289
''Water, Red,'' Cause of, W. L. Schmitt, 39
Waud, R. A. and H. G. Skinner, Measuring Capillary Fragility, 115
Weber, N. A., Timing Device for Speakers, 116
Wells, J. W., Hydrographic Work, 562
Whitaker, E. T., Aristotle, Newton, Einstein, 249, 267
White, P. R., Crown-gall Bacteria, 199
Whitmore, F. C., ''Starring,'' 473
Wicks, L. F. and V. Suntzeff, Glyoxal in Histological Fixations, 204
Wiener, A. S., Variants of the Rh Type, 182
Wilde, W. S., Live Rat Muscle Fibers, 202
Wildlife Society, W. P. Taylor, 185
Wilen, F., Apparent Time Acceleration with Age, 301
Williams, C. M. and L. E. Chadwick, Insect Flight, 522
Williams, R. H. and G. W. Bissell, Treatment of Thyrotoxicosis, 156
Williams, R. J., Isotel, Isotelic, 386
Witlin, B., Berkefeld Candles and Blood Plasma, 160
Wolff, H. G., Emotions and Gastric Function, 481; and C. Torda, Myasthenia Gravis, 224
Wolford, J. J., Mineral Deposits, 261
Woods, A. F., Potash in Texas and New Mexico Permian, 260
Words, Descriptive, O. N. Liming, 539
Wright, L. D. and A. D. Welch, Folic Acid, 179
Writing Lever, Gravity, H. R. Hulpieu, 116

Xanthine, Enzymatic, Oxidation, F. Lipmann and R. C. Owen, 246

Yeast Spores, Staining of, L. S. McClung, 159

Zoological, Nomenclature, International Commission, J. L. Peters, 9; Park and Aquarium, London, 102

SCIENCE

VOL. 98 FRIDAY, JULY 2, 1943 No. 2531

The Origin of Language: DR. E. L. THORNDIKE 1

Obituary:
Charles Frederick Marvin: DR. W. J. HUMPHREYS. *Recent Deaths* 6

Scientific Events:
The Birthday Honors of the King of England; The National Foundation for Infantile Paralysis; The International Commission on Zoological Nomenclature; The Tercentenary Commemoration of the Invention of the Barometer; The Pittsburgh Meeting of the American Chemical Society 8

Scientific Notes and News 10

Discussion:
The Concept of Cells Held by Hooke and Grew: PROFESSOR EDWIN B. MATZKE. *The Hydrolysis of d-Peptides:* DR. GRACE E. PICKFORD. *U. S. Text-Books for Students in Latin American Universities:* PROFESSOR E. RAYMOND HALL. *The Institute of Tropical Agriculture at Turrialba:* RAFAEL W. KEITH 13

Scientific Books:
Meteorology: DR. CHARLES G. ABBOT. *Anoxia:* DR. ROSS A. MCFARLAND 17

Special Articles:
Abolishment of Alimentary Lipemia Following Injection of Heparin: DR. P. F. HAHN. *Production and Treatment of Granulocytopenia and Anemia in Rats Fed Sulfonamides in Purified Diets:* DR. ARTHUR KORNBERG, DR. FLOYD S. DAFT and DR. W. H. SEBRELL 19

Scientific Apparatus and Laboratory Methods:
The Determination of Cell Volume and Hemoglobin on the Same Drop of Blood: DR. ALFRED T. SHOHL and LOUIS K. DIAMOND. *Growth of Orchid Seeds after Dehydration from the Frozen State:* DR. RUTH DOWELL SVIHLA and ELIZABETH OSTERMAN 22

Science News 10

Index to Volume XCVII i

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE ORIGIN OF LANGUAGE[1]

By Dr. E. L. THORNDIKE

PROFESSOR EMERITUS, TEACHERS COLLEGE, COLUMBIA UNIVERSITY

NOBODY knows when, where or how speech originated, and I am stepping in where wise scholars in linguistics and psychology fear to tread. My colleagues in psychology will, I beg, permit this divagation into speculation by one who has labored long in the less exciting fields of experiment and statistics. I ask and expect no mercy from experts in linguistic science, but only that they build a better theory on the ruins they make of mine.

We must first glance at three time-honored and then dishonored theories, now known by these opprobrious names: ding-dong theory, bow-wow theory and pooh-pooh theory.

The ding-dong theory assumed a mystical power of certain things to evoke certain sounds from men. Since each such sound was associated with the experience of the thing, it came to mean it. And since men were alike in their responses to things by sounds, one of these sounds meant more or less the same thing to all in the group, and easily became a vehicle of communication. All the evidence is against the existence of any such mystical power, and only extremely strong evidence would induce any scientific student of psychology or of language to put any faith in so extremely unlikely an origin of language.

The bow-wow theory supposed that men formed habits of using the sounds made by animals, things or events to mean the respective animals, things and events and that these habits started them on the road to inventing other sounds as signs of animals, things or events. For various reasons this theory is discredited. Doubtless after man has language, he will often make the sounds that animals and things make, but it is doubtful how often he will do so in a languageless group. Possibly he will do so only accidentally as a part of his general vocal play. There might be little agreement in the ideas evoked in the members of a human group by hearing the varying sounds which its various members made when they thought of a dog, a cow, thunder and the like.

---

[1] A lecture given on November 5, 1942, as one of the series of the William James lectureship at Harvard University.

Even if a group got a sufficient agreement in the case of forty or fifty sounds for these to be used commonly in the group, an advance by the addition of non-mimetic sounds as signs of things and events would be difficult. If the mimetic sounds remained fully mimetic, it might well be impossible. But the opponents of the bow-wow theory have not considered sufficiently the possibility that a human group might modify their vocabulary of mimetic sounds by slurring, abbreviation and other processes that make speech easier for the speaker without losing the old meanings of animals, things and events in the hearer. If close imitations of a dog's barking, cock's crowing, baby's crying, lamb's bleating, etc., became conventionalized within a human group into sounds no more like the originals than *bow-wow, cockadoodledoo, mama* and *bah-bah,* or *urr-urr, uk a duk a duk duk, na-na* and *buh-buh,* that group could in a few generations progress to a set of sounds many of which would mean primarily certain animals or things and only secondarily or not at all the sound made by the respective animals and things. The group's vocabulary would all be about things that had distinctive sounds, but could be in the form of sounds different from these and in some cases hardly suggestive of them. The invention of a non-mimetic sound for some thing hitherto nameless would then be easier. The use of such an invention would, of course, spread somewhat slowly within the group and very slowly outside it to groups accustomed only to mimetic words.

The pooh-pooh theory, or interjectional theory, supposed that the instinctive unlearned cries of man as a wordless animal, which already are sounds that are evoked by certain situations and evoke in human hearers certain equally unlearned responses of action and feeling, came to possess meanings also, and that on the basis of this vocabulary of familiar sounds meaning pain, surprise, fear, affection and the like, early man here and there used other sounds to mean other facts.

Nobody should doubt that part of this is true. To a mother whose baby cries and seeks her breast that cry probably means that the baby wants to be fed if anything means anything to her. If she can think of anything she will think of that, as well as react appropriately to it. But for various reasons students of language have decided that the attachment of meanings to the hearing or the making of these sounds of instinctive nature is not adequate to originate articulate speech. So-called animal language plus the power of thinking meanings would not produce human language.

An ingenious theory has been set forth by Sir Richard Paget, a physicist and student of phonetics, who argues that the total behavior of a man to a situation includes characteristic movements of the tongue and lips and other organs of speech. These gestures of the mouth parts became specially important when a man's hands were "in continual use . . . for craftsmanship, the chase, and the beginnings of art and literature," so that he could not gesture with them. Sounds were added to these "mouthings," and finally came to play the leading role. In Paget's own words:

> Originally man expressed his ideas by gesture, but as he gesticulated with his hands, his tongue, lips and jaw unconsciously followed suit in a ridiculous fashion, ''understudying'' (as Sir Henry Hadow aptly suggested to me) the action of the hands. The consequence was that when, owing to pressure of other business, the principal actors (the hands) retired from the stage—as much as principal actors ever do—their understudies—the tongue, lips and jaw—were already proficient in the pantomimic art.
>
> Then the great discovery was made that if while making a gesture with the tongue and lips, air was blown through the oral or nasal cavities, the gesture became audible as a whispered speech sound. If, while pantomiming with tongue, lips and jaw our ancestors sang, roared or grunted —in order to draw attention to what they were doing—a still louder and more remarkable effect was produced, namely, what we call voiced speech. . . .
>
> In this way there was developed a new system of conventional gesture of the organs of articulation from which, as I suggest, nearly all human speech took its origin. . . .
>
> We can now form a mental picture of how the process of speech-making actually began, but an example or two will make the argument clearer. If the mouth, tongue and lips be moved as in eating, this constitutes a gesture sign meaning ''eat''; if, while making this sign, we blow air through the vocal cavities, we automatically produce the whispered sounds mnyΔm–mnyΔm (mnyum), or mnIΔ–mnIΔ (mnyuh)—words which probably would be almost universally understood, and which actually occur as a children's word for food in Russian, as well as in English. . . .
>
> Another adult example may be given, namely, in connection with the beckoning gesture—commonly made by extending the hand, palm up, drawing it inwards towards the face and at the same time bending the fingers inwards towards the palm. This gesture may be imitated with the tongue, by protruding, withdrawing, and bending up its tip as it re-enters the mouth and falls to rest.
>
> If this ''gesture'' be blown or voiced, we get a resultant whispered or phonated word, like eda, eda or edra (according to the degree of contact between tongue and upper lip or palate) suggestive of the Icelandic hadr, the Hindustani idhar and the Slavonic ɪdeɪ—all of which bear much the same meaning as our English word

> "hither." If the same tongue gesture be finished more vigorously, the resultant word will end in a *k* or *g*, owing to the back portion of the tongue making a closure against the soft palate.
>
> Thus, by unconsciously using the tongue, lips, jaw, etc., in the place of the head, hands, etc., pantomimic gesture would almost automatically produce human speech.[2]

Paget fabricated words by moving his own jaws, tongue and lips in ways which seemed to him likely to have been used as oral gestures of primitive men accompanying manual or other gestures meaning reach up, draw back suddenly, scrape, wave aloft, shoot with a bow and arrow, sew, blow, plough, strip grains from the stalk, pick berries, collect them and bury them in the ground, and many others. He finds substantial correspondences between his fabricated sounds and certain words in old languages. Of the famous Aryan roots he considers that 77 per cent. are clearly pantomimic. For example, "tank—contract, compress—as in thong, is due to two compressions in succession fore and aft the palate." "da—give—seems to be an offering gesture made with the tongue."[3]

Paget's book "Human Speech" is so recent (1930) that his theory has not yet received a pet name. Using the first illustration that he gives we might call it the yum-yum theory. This, however, really misrepresents and unduly favors it; for the theory requires the mouth parts to pantomime not eating, drinking, sipping, blowing and other acts of the mouth parts themselves (nobody doubts that), but movements of other parts of the body. A truer nickname would be the "tongue-tied" theory, meaning that the tongue is yoked with the body by subtle bonds of mimetic kinship. The theory has been accepted by at least one psychologist, Eisenson, but it has not been acceptable generally. Personally, I do not believe that any human being before Sir Richard Paget ever made any considerable number of gestures with his mouth parts in sympathetic pantomine with gestures of his hands, arms and legs, still less that any considerable number of men in any local community made the same oral gestures in such pantomine.

And now for my theory, which is a humdrum affair compared with any of these four.

Let us assume a group of one or more human families living together at least as continuously as one of the groups of chimpanzees studied by Nissen in their natural habitat. Let us assume that their environment includes, besides the untouched objects of nature, a few objects chosen and preserved as tools, say a few pounders, a few cutters, a few gourds, shells or other dippers and holders, and perhaps a few stabbers and scrapers; and also some natural objects chosen and preserved as playthings, things that one can chew on, roll or throw, make a noise with, and the like.

We may safely assume further that these humans made a wide variety of movements with their hands, much the same as the human infants of to-day instinctively make, pushing, pulling, tearing, putting into their mouths, dropping out therefrom, dropping, throwing, picking up, etc., etc.

We may safely assume further that these humans made a variety of sounds like the meaningless prattle of infants, letting their mouth parts play with their voices in the same multifarious way that their hands play with any obtainable object. The variety of sounds made may indeed have been greater than that made by an infant of to-day, whose vocal play may be narrowed by the elimination of sounds which are alien to the language which his environment favors. And we know that an infant of to-day makes a much wider variety of articulate sounds than the language of his parents contains.

Such a person in such a group would at an early age have a memory image or expectation or idea of the appearance of the person who nursed him, which her voice or smell or caress could evoke though she was unseen. By having been experienced in so many different contexts, some image or expectation or idea referring to her would have acquired an existence independent of any particular sequence of behavior. In a similar manner he would have an image or expectation or idea referring to each object that had been associated with many varying concomitants in his uses of it or play with it.

Such a person would prattle while he worked or played much as a child of a year or two now prattles as he plays. If his making a certain sound became connected with his experiencing a certain object or act and having an image or expectation or idea of that object or act, he would have a language. That sound and the act of making it would mean that object or act to him. It would be a private language useless as yet for communication. It would be a narrow language consisting of only a few words referring mostly to his own acts and possessions, to the persons in the family group and to their acts and possessions. But it would be genuine language.

And it would be a valuable intellectual tool for its possessor, enabling him to replace the somewhat cumbrous and elusive images or expectations by sounds that he could make and arrange more or less at will. If he did connect *ik* with his digging stick, and *üg* with his large turtle-shell container, *yum* with truffle and *kus* with clam, he could plan an expedition to get truffles or one to get clams more easily and conveniently than he could with only pictorial memories. Consequently, we may safely reckon that any person who made these connections that gave sounds meanings and gave things symbolic equivalents would keep them, even though he alone understood them.

---

[2] R. Paget, "Human Speech," pp. 133–138, *passim*, 1930.

[3] *Ibid.*, p. 149.

What now is the probability that a person brought up in a languageless family group would form one such connection whereby a sound (not an instinctive cry of pain, delight, triumph, etc.) meant an object? What is the probability that he would form two such? Three? Four? A dozen? A score?

Properly planned experiments with enough infants brought up in a languageless environment for ten years (perhaps for a much shorter time) would give a decisive answer. I have long wished to make systematic observations of infants in linguistically underprivileged environments, but have never been able to find the time, and must rely upon memories of casual observations of my children and grandchildren in making my estimates.

I think that the probability that a person in the top half of the species for intelligence by birth would make four or five such connections is very high, say seven out of ten. Consider a child of early man playing with a large shell used as a container in the household and prattling as he plays. Let us take the state of affairs least favorable to connecting the sound *üg* with that shell.

Let his prattling possibilities consist of a thousand syllables all equally likely to occur, and all as likely to occur in any one situation as in any other. Then the chance that he will utter *üg* as he puts a pebble in the shell is 1 in 1,000 if he prattles at all. And unless that connection between the manual act and the vocal act is somehow strengthened, he will be as likely the next time that he drops a pebble into that shell to utter any other sound in his repertory as to utter *üg*. Very often he will utter other sounds and no progress will be made toward the attachment of meanings to his utterances.

But there are forces which tend to cause progress away from purely miscellaneous vocal play. First of all the child who puts one pebble in the shell is likely to put another in then and there. His enjoyment of the act makes him repeat it, that is, strengthens its connection with the mental set in which he did it first. Now that mental set happened at that time to evoke also the vocal play of saying *üg*, and the confirming reaction which the enjoyment of the manual play set in action tends to spread or scatter so as to strengthen also the connection of the situation with the utterance.

In the second place, saying *üg* to the shell and pebble may be itself enjoyable and the connection may thereby be strengthened. Consequently, the probability that the child will drop a second pebble is substantial and the probability that he will utter *üg* therewith if he utters anything is far above 1 in 1,000.

Let us assume provisionally that some active-minded Homo Sapiens did thus connect *ma* with the mother who nursed and fondled him, *ba* with the round black thing that rolled and tossed, *unk* with the club with which he knocked down his prey, and similarly for a dozen or more "words," as we may truly call them. If he did this, what would be the probability that some second person in the group would come to understand these words? And if he did come to understand them, what would be the probability that the first person would come to use them with the intent of having the second person understand them, and so attain the condition of possessing speech as a social tool?

If one person in a hitherto languageless group of two or three dozen souls has reached the stage of a private language of a score of words the probability that some other person in the group will come to understand three or four of his words is much more than infinitesimal.

His companions might well hear him say *kuz* as he dug up a clam or opened a clam or ate a clam, a hundred times in a week. Even if they paid no more attention to his speech than to his personal play, vocal or non-vocal, the sound *kuz* would tend to make them think of a clam more often than of any other one object. And under certain conditions they would be attentive to his speech. For example, in a group digging for clams together, if one cried *kuz* whenever he found a clam, the cry would become interesting to others.

If the group had a dozen or so "bow-wow" (that is, mimetic) words that they used as signals, they would be thereby the more disposed to attend each to the other's vocalizations. If a second person of the group had a private language of his own, though unlike that of the first person in every particular, the second person would be thereby the more disposed to attend to the first person's vocalizations. If the group had a system of mutual influence by gestures, even one utterly devoid of any vocal accompaniments, its members would be thereby a little more disposed to attend to the vocal behavior one of another.

So I would set the probability that in a group of thirty souls, one of whom had a private language of twenty words, some one other person would come to understand five of these words in the course of a moderate lifetime of thirty-five years as well above one in ten thousand, and probably above one in a thousand.

If the family group of say thirty souls has an inventor of a private language of say twenty-five words and say ten of the thirty understand say eight of the words, what is the probability that any one of these ten will use any of the eight words that he understands, use it, that is, to mean to himself the thing or act or event in question? This probability is substantial, but it is not 100 out of 100. Some persons in such a group will hear and understand a word hundreds of times, but in all probability never say it at all, except accidentally as an element in their meaningless chatter. But some will, when they themselves utter this word in their meaningless chatter or for any reason, understand it as if it were spoken by A. And this act of saying a word and having it mean something will tend to be satisfying rather than annoying. Meaningful prattle is more satisfying than meaningless and will therefore be more frequently repeated.

If A, the original inventor, hears B or C or D say one of the words to which he, A, attaches meaning when he himself says them, what is the probability that he, A, will understand the word spoken by B? It is not 100 out of 100. The connection *kuz*→*clam* may remain confined to *kuz* said by A, because A is stupid or by nature an extreme introvert or what William James called a lonely thinker, or because of the general tendency of connections to operate only in the way in which they are formed. But A has, by hypothesis, an IQ of 100 or better, and if B goes about saying *kuz* repeatedly and as if he meant something, A is likely to notice what B says, and will at least be more likely to attach the thought of clam to the sound *kuz* when made by B than to attach any other one meaning to it. I should conjecture that the probability of A's understanding B would be well over 25 in 100 and under 90 in 100.

It is perhaps time to attach a name to the theory which I am expounding. Let us save everybody trouble by giving it an opprobrious name from the start! Since it relies on the miscellaneous vocal play of man instead of his alleged mimetic or emotional utterances, it could be called the "babble-babble" theory. Since it starts with languages private to single persons, and progresses gradually toward speech in the full speaker-hearer relation (which, indeed, my exposition has not yet reached) it could be called the "onety-twoty" theory. Since it depends on successive selections of chance variations in sound-reality connections, it could be called the "chancey-chance" or "luck-luck" theory. Or we may combine its two main dynamic features and call it the babble-luck theory.

Let us continue with the luck-luck course of the babble-luck theory.

If B understands *kuz* as spoken used by A and A understands *kuz* as spoken by B, what is the probability that A will come to use the word as a means of influencing B? What is the probability that B will come to *use* the word to influence A?

It is not 100 out of 100. A and B might continue for years to get meaning from one another's use of the word, but never use it for any purpose other than as a self-reminder or as an aid in personal plans or for self-entertainment. However, if A said *kuz* when he was about to set forth to dig clams, and B was moved by hearing *kuz* to set forth to dig clams also, and so accompanied A on several occasions, there might fairly easily be built up a habit in A of saying *kuz* when he wanted B's company on a clamming trip. (The formation of this habit would not be as simple as this sounds or by one direct linking, but by various cooperating associative links which I could describe if necessary). Or if A had already a habit of purposive communication with B by means of a gesture such as pointing to a clam and to B's mouth when he wished or permitted B to eat it, A might well happen to say *kuz* along with the two gestures and eventually in place of the former gesture. (Here again the substitution would not be as simple as it sounds, but it could come to pass.)

A and B thus reach a stage where a word is used by one of them, say by A, with the expectation that his saying it in the presence of the other will produce or favor certain behavior in the other, and where A has the habit of saying it to the other as an appropriate thing to do when a certain desire or purpose moves him. This is genuine human language used in the speaker-hearer relation. But the relation is, as yet, unidirectional, from A as speaker to B as hearer.

Speech need not progress further to full two-way, give-and-take speech, but it could, and often would. I will not run the risk of wearying you with the probabilities that the normal operations of repetition and reward would lead men to this final stage. They are high.

Each of the stages that I have described, from that of words used privately to purposive use of speech in the full speaker-hearer relation, was self-sustaining, by adding something to the group's balance of satisfactions, or to its chance of survival, or to both. A one-man language could make that man remember, anticipate and plan better. In so far as others understood A's words, each of them had some profit from A's experience in addition to their own. In so far as they used his words, each had a private language without originating it. When they reached the stage of understanding one another certain experiences of any one were of profit to all. The stage of purposive use of words to modify the behavior of another gave the possibility of increasing costless cooperation and decreasing costly interference of person with person. Even if the words used were few and the occasions of their use limited to a very narrow round of suggestions, commands, invitations and reports, the benefits would still be enough to maintain the linguistic activities.

Nothing in all this so far requires that either A or B thinks of the other as imagining or meaning clams when he says *kuz*. Such imputation of an inner life to another may arise later and regardless of communication, though of course it can not progress far without communication. How it arises is a fascinating problem, but to discuss it would make far too long an interruption of our present task.

Let us turn rather to some possible criticisms. First it will be said that the speech which I have derived from babble by luck is a pitifully small, crude affair in comparison with the speech of any known group present or past. This criticism is true. Even after a dozen or more words had been used purposively hundreds of times by a third of the family group and understood after a fashion by two thirds of the group, the use and understanding would be nowhere nearly as clean-cut as that of a modern man or child. A person could use words more or less appropriately in certain situations in the sense that the use of the word was much more appropriate on the average than saying nothing, or than saying some other word of those in his active vocabulary. He could understand words in the sense that what he did to the total situation including the word was on the average different from what he would have done if some other word had been there, and better than what he would have done if no word had been there. But when the imperfect appropriateness of a speaker's uses was combined with a hearer's inadequate understandings, a perfect result could not be expected. If the speaker went much beyond the regular routine uses, he would arouse misunderstanding, neglect or perplexity. The group's linguistic activities might be clumsy as well as extremely narrow.

It will be said that the evolution of any language worthy of the name from such crude beginnings is problematic. This criticism also is true, but it is not very damaging. The problems are no harder than the problems of the evolution of mechanical tools from their crude beginnings. The evolution of a vocabulary of two hundred names of acts, objects and events from a vocabulary of twenty is a problem, though a rather easy one.[4] The evolution of a language that can mean qualities and relations as well as objects and events is a further problem. The evolution of a language that can by sounds ask questions, distinguish orders from statements and date events has further problems. Refinements of meaning, as by our adjectives and adverbs, and abbreviations of speech, as by our pronouns, involve further problems.

I have not solved these and other problems. But I think they are all soluble. If the facts which I have related account for how men came to use articulate words with the purpose of influencing other men, to understand such words and to cooperate in the speaker-hearer relation, they can fairly be said to account for the origin of language, but to leave us with many problems of its development.

A third possible criticism is that the babble-luck doctrine should have produced dozens, maybe hundreds of different languages of this beggarly sort. Origin from miscellaneous babble would cause a multiplicity of primeval languages unless one family group got so great a head start that its language spread to all other tribes before they had invented any languages of their own, which is unlikely. I see nothing objectionable in this. It seems to me sure that any continuing group of intelligent human beings would in time get a language from "babble and luck" if they did not get it earlier from neighbors or visitors who already had it. In many cases they would get it so. Inter-group learning would be of the same general nature as the intra-group learning.

A fourth possible criticism is that hundreds of generations seem to be required to get even this beggarly language if the group has no aid from outside. This seems to be really an argument pro rather than con. Surely the notion that primeval men who were wordless got words as quickly as modern men got Mohammedanism or Christianity or steam engines is fantastic. The length of time from selecting and using flints that were sharp to chipping flints to make them sharp, and the length of time from chipping them roughly to chipping and polishing them in the elegant neolithic styles are both reckoned in many thousands of years.

Whatever may be the value of this account of the origin of meaningful speech, one thing is certain. The human animal's miscellaneous play with his vocal apparatus and the articulate sounds he thereby produces and the associations he makes of these with things and events independently of, and especially contrary to, his linguistic environment deserve much more attention from psychology and linguistic science than they have hitherto received.

OBITUARY

CHARLES FREDERICK MARVIN

DR. CHARLES FREDERICK MARVIN, former chief of the United States Weather Bureau, died in the early morning of June 5, 1943, at Doctors Hospital, Washington, D. C., of heart failure following a recent operation. He was born at Putnam (now Zanesville), Ohio, October 7, 1858, son of Charles F. and Sarah A. (Speck) Marvin; and was educated at the public schools of Columbus, Ohio, and the Ohio State University, which awarded him the degree of M.E. in 1883 and of Sc.D. (honorary) in 1932. From 1879 to 1883 he taught mechanical drawing in this university and instructed in its mechanical and physical laboratories. In 1884 he was appointed a junior professor in the Office of the Chief Signal Officer of the U. S. Army, where he remained until the establishment of the Weather Bureau in 1891. After this date and through several administrative changes, he served as "professor of meteorology" until 1913, when, following the recommendation of the National Academy of Sciences, President Wilson appointed him chief of the Weather Bureau, a position he held until his retirement in 1934, after 50 years of service.

---

[4] One generation having reached the linguistic status I have described, the second generation can learn from it and spend most of its linguistic activity in adding its inventions to the parental stock. The custom of naming things and acts by sounds may, after a certain number of such sound-meaning connections has been reached, become a conscious deliberate habit. Some early linguist may then devote his spare time to naming every person in the group, every animal that frequents the locality, and every tool or weapon that he uses.

Dr. Marvin's services to the Weather Bureau and to meteorology naturally had to do with several branches of this science. His principal contributions were in the designing, construction and standardizing of meteorological instruments of many kinds; and in guiding the policies of the Bureau during the early stages of its transition into an important influence in the present era of aeronautical expansion. The leadership of the Weather Bureau was his responsibility during troublous times; his inherent qualities of judgment and stability played their part in his administration of the Bureau's affairs.

Above all, his interest in improving the exactness of meteorological measurements stood out. For nearly every weather element—wind direction, wind velocity, barometric pressure, evaporation, cloudiness, precipitation (both rain and snow), duration of sunshine, intensity of sunshine, temperature, humidity—he developed one or more measuring and automatically recording devices, either original or modified, and designed to improve meteorological observations and records for a variety of public uses. One of his most important contributions in this connection, and also one of his earliest, was the experimental evaluation of the constants in humidity equations and the construction of humidity tables; it is from these tables that one can read off at once the current humidity of the air as soon as he knows the simultaneous readings of a properly exposed dry thermometer and an adequately ventilated wet thermometer—information valuable on its own account, and vital to the forecasting of the coming weather of the next few to 24 hours.

Of all the meteorological instruments, however, the Robinson cup anemometer, to measure the velocity of the wind, seemed to fascinate him most. He worked on it, effectively, and wrote about it, from early in his career with the Weather Bureau until years after his retirement. Another of the studies and one of particular significance in early systematic investigation of the upper air was the design and construction of kites and kite instruments.

Besides these distinctly meteorological contributions, he found time and energy to devote to other practical and important interests—notably the design and building of seismographs and the reform of the calendar. One of his seismographs was in operation at the Central Office of the Weather Bureau in Washington, D. C., for many years, and when finally dismantled was one of the best mechanically recording seismographs then in use anywhere. His work with calendar reform, devoted and constant though it was, found the inertia of public conservatism in this subject too great to be overcome by logic. Dr. Marvin was a member of a number of scientific societies, among them the American Geophysical Union; the American Meteorological Society (president, 1926); the Washington Philosophical Society (president, 1903); the Washington Academy of Sciences, and the National Advisory Committee for Aeronautics.

In 1928 he was knighted by the King of Norway to the Order of St. Olaf, first order, in recognition of the aid given by the Weather Bureau to Raold Amundsen during his Arctic explorations; and in 1934 was a U. S. delegate to the League of Nations at Geneva.

He was a member of the Cosmos Club of Washington, D. C.

Dr. Marvin was three times married: to Nellie Limeburner, June 27, 1894, died February 27, 1905; 2d, to Mabel Bartholow, November 8, 1911, died February 8, 1932; 3rd, to Sophia A. Beuter, November 12, 1932, died February 3, 1943. He is survived by two daughters, Mrs. E. Parks Norwood, of Tucson, Arizona, and Mrs. Claud Livingston, of Kenwood, Md., and one son, Charles F. Marvin, Jr., of Washington, D. C., all children by his first wife; and by six grandchildren.

W. J. HUMPHREYS

U. S. WEATHER BUREAU,
WASHINGTON, D. C.

RECENT DEATHS

DR. KARL LANDSTEINER, emeritus member of the Rockefeller Institute for Medical Research, died on June 26 at the age of seventy-five years. Dr. Landsteiner was Nobel Laureate for Medicine in 1930.

DR. STANLEY E. COULTER, emeritus dean of the School of Science of Purdue University, died on June 26 at the age of ninety years.

DR. JAMES MCGIFFERT, head of the department of mathematics at the Rensselaer Polytechnic Institute, Troy, N. Y., died on June 18 at the age of seventy-five years. He had been a member of the faculty since 1892.

DR. GILBERT A. YOUNG, since 1912 until his retirement with the title emeritus in 1942 head of the

School of Mechanical Engineering of Purdue University, died on June 27 at the age of seventy-one years.

Dr. George Curtis Martin, from 1909 to 1924 geologist of the Geological Survey, later consulting geologist, died on June 23. He was sixty-seven years old.

Nature records the death on April 24 at the age of seventy-four years of Lionel R. Crawshay, at one time a member of the scientific staff of the Marine Biological Association and for many years research officer of the Sponge Fishery Investigations in the West Indies and British Honduras, and of Professor Kurt Huber, professor of experimental psychology in the University of Munich, recently executed for "traitorous conspiracy."

SCIENTIFIC EVENTS

THE BIRTHDAY HONORS OF THE KING OF ENGLAND

It is stated in *Nature* that the following names of men of science and others associated with scientific development appear in the Birthday Honors list of the King of England:

Baronet: Sir John Fraser, regius professor of clinical surgery, University of Edinburgh.

K.C.B.: Dr. N. K. Johnson, director of the Meteorological Office.

K.B.E.: Sir T. Franklin Sibly, vice-chancellor of the University of Reading and chairman of the Committee of Vice-Chancellors and Principals.

Knights: Captain J. P. Black, managing director of the Standard Motor Co., Ltd., and chairman of the Joint Aero-engine Committee; D. A. E. Cabot, chief veterinary officer, Ministry of Agriculture; Dr. H. L. Eason, president of the General Medical Council; Dr. C. S. Fox, director of the Geological Survey, India; Dr. H. Spencer Jones, astronomer royal; J. M. Kennedy, deputy chairman of the Electricity Commission; P. M. Kharegat, vice-chairman, Imperial Council of Agricultural Research, India; E. Macfadyen, chairman of the governing body, Imperial College of Tropical Agriculture; Dr. A. D. McNair, vice-chancellor of the University of Liverpool; Professor J. L. Myres, formerly Wykeham professor of ancient history, University of Oxford, for services to learning; Professor G. P. Thomson, professor of physics, Imperial College of Science and Technology.

C.H.: E. W. Hives, for services in the design of aero-engines.

C.B.: J. M. Caie, deputy secretary, Department of Agriculture for Scotland; W. S. Farren, director, Royal Aircraft Establishment, Ministry of Aircraft Production.

C.I.E.: H. Trotter, utilization officer, Forest Research Institute, Dehra Dun.

C.B.E.: R. Chadwick, chief designer and director, A. V. Roe and Co., Ltd.; Dr. H. L. Guy, chairman of the Gun Design Committee, Scientific Advisory Council; Professor J. Jewkes, deputy director-general of statistics and programs, Ministry of Aircraft Production; Professor J. N. Mukherjee, professor of chemistry, University of Calcutta; R. K. Pierson, chief designer, Vickers-Armstrong, Ltd. (Aircraft); Major R. W. Sharpe, chairman, Agricultural Executive Committee, Berwickshire; Lieutenant-Colonel W. W. Zambra, secretary, Imperial Communications Advisory Committee.

THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS

Twenty-eight grants, amounting to $354,370, have been made by the National Foundation for Infantile Paralysis to universities, hospitals, laboratories and other organizations in eleven states to continue the fight against the disease. Dr. Basil O'Connor is president of the foundation.

The grants were recommended by the medical advisory committees at the semi-annual meeting and have now been approved by the board of trustees. The funds which make the program possible are raised annually in January through the celebration of President Roosevelt's birthday.

Sixteen grants, amounting to $216,020, were made for virus and after-effects research. Four of these are on long-term projects being conducted at Yale University, the Johns Hopkins University, the University of Michigan and the University of Wisconsin.

Twelve grants, amounting to $138,350, were made for various educational programs including the training of technicians in the Kenny method of treatment. Some of these grants include projects for educational work for physicians and the public. The sum of $2,500 was appropriated for the preparation of a complete bibliography on poliomyelitis. The compilation is being done for the foundation with the aid of the library of the American Medical Association and the John Crerar Library, both in Chicago.

The list by states follows:

California

Stanford University School of Health (Women)	$ 11,820
American Physiotherapy Association, Stanford University	10,000
Stanford University	6,800

University of California Medical School, San Francisco	4,650	
Total		$ 33,270
CONNECTICUT		
Yale University School of Medicine for the Yale Poliomyelitis Study Unit, New Haven (1st year of a 5-year grant)		37,200
GEORGIA		
Warm Springs Foundation, Warm Springs		43,480
ILLINOIS		
University of Chicago	$ 7,500	
Northwestern University Medical School, Chicago (2 projects)	6,700	
American Medical Association, Chicago	2,500	
Total		16,700
IOWA		
State University of Iowa, Iowa City		1,000
MARYLAND		
The Johns Hopkins University for the Center for the Study of Infantile Paralysis and Related Virus Diseases, Baltimore (2d year of a 5-year grant)		38,320
MASSACHUSETTS		
The Children's Hospital, Boston (2 projects)	$ 11,400	
Harvard Infantile Paralysis Commission, Boston	10,000	
Massachusetts General Hospital, Boston	3,300	
Total		24,700
MICHIGAN		
University of Michigan School of Public Health, Ann Arbor (1st year of a 3-year grant)	$ 40,000	
Michigan Department of Health, Lansing	19,950	
Wayne University College of Medicine	5,000	
Total		64,950
NEW YORK		
National Organization for Public Health Nursing, New York City (2 projects)	$ 31,100	
National League of Nursing Education, New York City	16,500	
University of Rochester School of Medicine and Dentistry, Rochester	14,800	
Teachers College, Columbia University, New York City	1,750	
New York Medical College Flower and Fifth Avenue Hospitals, New York City	500	
Total		64,650
PENNSYLVANIA		
University of Pennsylvania, Philadelphia	$ 10,000	
D. T. Watson School of Physiotherapy, Leetsdale	4,500	
Total		14,500
WISCONSIN		
University of Wisconsin, Madison (3d year of a 5-year grant)		15,600
Grand Total		$354,370

THE INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

THE International Commission on Zoological Nomenclature is issuing a series of opinions on cases which have been submitted to the commission prior to 1939 and on which a sufficient number of votes have been received from the commissioners.

Opinions of the International Commission on Zoological Nomenclature were formerly published in the Smithsonian Miscellaneous Collections. This new series of opinions, which begins with No. 134 and goes through 144, are published at the Publications Office of the Commission, 41, Queens Gate, London, S.W. 7.

The commission has also commenced the publication of *The Bulletin of Zoological Nomenclature,* the official organ of the Commission on Zoological Nomenclature; Part 1 of Volume 1 was published on May 21, and the second part was published in June. Subscriptions for the *Bulletin* may also be sent to the Publications Office.

JAMES L. PETERS,
Assistant Secretary

THE TERCENTENARY COMMEMORATION OF THE INVENTION OF THE BAROMETER

IT is announced that a tercentenary commemoration of the invention of the barometer will be held at the University of Toronto on October 19.

There will be two meetings, one in the afternoon and the other in the evening. The program follows:

2:00 P.M. (1) "Telescope, Microscope and Barometer as a Point of Departure for the Natural Sciences." By Louis C. Karpinski, University of Michigan.
(2) "The Effects of the Discovery of the Barometer on Contemporary Thought." By G. S. Brett, University of Toronto.
8:00 P.M. (1) "Subsequent History of the Barometer."

By W. E. Knowles Middleton, Meteorological Office, Toronto.

(2) "The Applications of the Barometer in Physics and Chemistry." By John Satterly, University of Toronto.

In proposing that this celebration be held in time of war the participating organizations are expressing their belief that other forces than those of evil will prevail and that the continuity of human endeavor is worthy of emphasis, particularly in these disturbed days.

THE PITTSBURGH MEETING OF THE AMERICAN CHEMICAL SOCIETY

"CATALYSIS of War Chemistry" will be the central theme of hundreds of papers and addresses to be presented before the one hundred and sixth meeting of the American Chemical Society, which will be held in Pittsburgh from September 6 to 10.

Advances in wartime research will be reported at the scientific sessions, of which Dr. Per K. Frolich, director of the Chemical Division, Esso Laboratories of the Standard Oil Development Company, Elizabeth, N. J., is president.

"Manpower" will be the subject of a three-day symposium at which industrial leaders will discuss measures to overcome the shortages of trained scientific workers essential to the war effort. W. L. Elder, of the War Production Board, will preside.

The food needs of the United States, civilian and military, and of the United Nations will be explored in symposia dealing with recent advances in the chemistry of dairy products, vitamins, proteins and boron in agriculture.

Other symposia will be devoted to anti-syphilitic agents, industrial hygiene, research tools of the colloid chemist, research management in small laboratories, unit processes, paint, plastic, reactions of solids, molecular addition compounds and library technique.

Papers to be read at divisional meetings will outline progress in petroleum, gas and fuel, fertilizers, sugar chemistry and technology, cellulose, water, sewage and sanitation and chemical education. The society's divisions of organic chemistry, physical and inorganic chemistry, biological chemistry, analytical and microchemistry, colloid chemistry and industrial and engineering chemistry will also convene.

Francis C. Frary, director of research of the Aluminum Company of America, has been appointed honorary chairman of the convention. Professor J. C. Warner, of the department of chemistry, Carnegie Institute of Technology, is general chairman. William P. Yant, director of development and research, Mine Safety Appliances Company, is general vice-chairman. An attendance of four thousand is expected.

According to the announcement, in attacking the problems of manpower, first-hand knowledge of the experience of the United Nations will be drawn upon.

> The record of the American chemical industry in terms of production has been excelled by none and equaled by few.
>
> The tremendous increase in requirements resulting from a huge construction program, the loss of men to the armed forces, the lack of an officially sanctioned training program for replacements, and the use of college and university facilities by the Army and Navy have created a difficult situation.
>
> In the manpower symposium, both current and anticipated shortages will be discussed. Plans to improve existing conditions will be suggested by experts familiar with the employment of women, with successful training programs, draft deferment and other fields concerned with the problem of recruiting personnel for industry.

The symposium on antisyphilitic agents, lasting two days, will be sponsored by the division of medicinal chemistry, of which John H. Speer, of G. D. Searle and Company, Chicago, is chairman. Technological developments in industry will be traced in a unit process symposium at which Professor R. Norris Shreve, of Purdue University, will preside.

F. J. Curtis, of the Monsanto Chemical Company, St. Louis, will be the chairman of the symposium on research management of small laboratories under the auspices of the division of industrial and engineering chemistry. The divisions of biological chemistry and agricultural and food chemistry will hold joint sessions on vitamins.

Divisional meetings will begin on Monday, September 6, at 9 A.M. and conclude on Friday at 2 P.M. Sessions are planned of the council and board of directors, of which Thomas Midgley, Jr., vice-president of Ethyl Corporation, is chairman. A public meeting at which general addresses will be delivered has been arranged for Wednesday, September 8. The headquarters of the convention will be at the Hotel William Penn, where registration of delegates will begin on Sunday afternoon, September 5.

SCIENTIFIC NOTES AND NEWS

THE Lamme Medal, awarded annually for "outstanding achievement in engineering education," was presented on June 19 by the Society for the Promotion of Engineering Education to Professor Thomas Ewing French, head of the department of engineering drawing at the Ohio State University. The presentation was made by Dr. Henry T. Heald, president of the Illinois Institute of Technology and retiring president of the society, at its golden anniversary dinner.

DR. DAVID RUSSELL LYMAN, of Wallingford, Conn., was presented with the Trudeau Medal for 1943 at the St. Louis meeting on May 5 and 6 of the National Tuberculosis Association.

FRANK H. SHAW, president of the Shaw Insulator Company of Irvington, N. J., received the John Wesley Hyatt Award, a gold medal and $1,000, for distinguished achievement in plastics during 1942 in recognition of his invention and development of transfer moulded plastics. The presentation was made on June 17 at a dinner in the Waldorf-Astoria, New York, by Dr. Per K. Frolich, president of the American Chemical Society and a member of the award committee. The award was established in 1941 by the Hercules Powder Company.

DR. CARL ALFRED MOYER, assistant professor of surgery at the School of Medicine of the University of Michigan, was recently presented with the annual Henry Russel Award in recognition of research on the physiology of breathing and the effect of various drugs on the respiratory processes.

AT the recent commencement of the University of North Carolina, Dr. T. Grier Miller, clinical professor of medicine at the Medical School of the University of Pennsylvania, in charge of the gastro-intestinal division of the University Hospital, was awarded the degree of doctor of laws.

THE University of Arizona has conferred the honorary doctorate of science on E. C. Slipher, of the Lowell Observatory at Tucson.

AT the seventy-third commencement exercises of Wilson College, the degree of doctor of science was conferred on Dr. Gertrude Rand, research associate in ophthalmology of the Knapp Foundation of the College of Physicians and Surgeons, Columbia University.

THE officers, executive committee and members of the Division of Geology and Geography, National Research Council, for the year beginning July 1, are as follows: *Chairman,* William W. Rubey; *vice-chairman,* Otto E. Guthe; *Executive Committee,* William W. Rubey, Otto E. Guthe, Marland Billings, Monroe G. Cheney, G. Arthur Cooper, Richard J. Russell. *Representatives of Societies:* Marland Billings and T. S. Lovering, Geological Society of America; Paul F. Kerr, Mineralogical Society of America; G. Arthur Cooper, Paleontological Society; Otto E. Guthe and Richard J. Russell, Association of American Geographers; Elizabeth T. Platt,[1] American Geographical Society; Charles H. Behre, Jr., Society of Economic Geologists; George W. Morey, American Ceramic Society; Monroe G. Cheney, American Association of Petroleum Geologists; John A. Fleming, American Geophysical Union. *Members at Large:* Ralph H. Brown, William W. Rubey and Joseph T. Singewald, Jr.

DR. ROBERT M. GATES, president of Air Preheater Corporation, New York City, has been nominated for president of the American Society of Mechanical Engineers.

THE Mayo Foundation Chapter of Sigma Xi held its annual meeting on June 10, when new members were initiated. The officers elected for 1943–44 are: *President,* Dr. R. K. Ghormley; *Vice-president,* Dr. H. E. Essex; *Secretary-Treasurer,* Dr. C. F. Code. The retiring president, Dr. A. C. Broders, spoke on "The Relationship of Birds to the Economy of Man."

SIR FARQUHAR BUZZARD, BT., lately regius professor of medicine at the University of Oxford, has been elected to an honorary studentship at Christ Church.

IT is reported in *Nature* that at the anniversary meeting of the Linnean Society, London, held on May 24, A. D. Cotton, keeper of the Herbarium in the Royal Botanic Gardens, Kew, was elected president in succession to Dr. E. S. Russell.

AT the annual general meeting of the Physical Society, London, held on May 18, the following officers were elected for the year 1943–44: *President,* Professor E. N. da C. Andrade; *Vice-Presidents,* Dr. J. H. Brinkworth, Professor C. D. Ellis, Dr. H. T. Flint, Professor N. F. Mott; *Treasurer,* Dr. C. C. Paterson; *Secretaries,* J. H. Awbery (*Papers*), Dr. W. Jevons (*Business*); *Foreign Secretary,* Sir Owen Richardson; *Librarian,* Professor L. C. Martin.

PROFESSOR RAYMOND C. ARCHIBALD became professor of mathematics emeritus at Brown University on June 30. He has been for thirty-five years a member of the department of mathematics, and was at one time editor-in-chief of the *American Mathematical Monthly.* He plans in his retirement to continue to edit "Mathematical Tables and Aids to Computation," published by the National Research Council since last January, as the organ of a committee of the council of which he is chairman. At the request of a committee of colleagues and former colleagues and students he sat recently for a portrait which has been completed and which will be presented to the university in the autumn.

AT Yale University Dr. William U. Gardner has been promoted to be professor of anatomy and chairman of the department of anatomy in the School of Medicine. In both of these appointments he succeeds the late Professor Edgar Allen, who died on February 5, 1943, while on active duty with the U. S. Coast Guard Reserve. Dr. Harry S. N. Greene, associate professor of pathology and surgery, has been appointed professor of pathology. Albert G. Conrad, associate professor of electrical engineering and co-inventor of a new adjustable-speed electric motor, has been appointed chairman of the department of electrical engineering. Cornelius B. Osgood, associate professor of anthropology and curator of anthropology in the Peabody Museum, has been appointed chairman of the department of anthropology.

---

[1] Although Miss Platt died on May 22, her successor on the division has not yet been appointed. Therefore, to show that the American Geographical Society is represented on the division, it seems best to indicate that Miss Platt was the representative for this period.

Dr. Raymond B. Allen, executive dean of the Chicago Colleges of the University of Illinois, has been appointed, from September 1 next, dean of the Medical School. He will succeed Dr. David J. Davis, who is retiring. Dr. Allen will continue in his present position of executive dean of the Chicago departments, which include the colleges of medicine, dentistry and pharmacy and other institutions associated with these units.

Dr. Granville A. Bennett, associate professor of pathology at the Harvard Medical School, Boston, has been appointed professor of pathology and bacteriology at the School of Medicine of Tulane University of Louisiana.

Dr. Burrell O. Raulston, professor and head of the department of medicine and director of clinical teaching since 1930, has been appointed professor of bacteriology and dean of the School of Medicine of the University of Southern California at Los Angeles. He succeeds Dr. Seeley G. Mudd, who will continue as professor of experimental medicine.

Professor Arthur Holmes, of the University of Durham, has succeeded T. J. Jehu as regius professor of geology and mineralogy at the University of Edinburgh.

Dr. Edward David Hughes has succeeded Dr. Kennedy Orton as professor of chemistry at the University of North Wales, Bangor.

Professor E. J. Salisbury, F.R.S., Quain professor of botany at University College, London, has been appointed director of the Royal Botanic Gardens, Kew, the appointment to take effect on September 1.

Dr. Jorge Ancizar-Sordo, director of the National Chemical Laboratory, Bogotá, Colombia, and president of the Colombian Chapter, American Society of Agricultural Sciences, has been appointed a member of the board of directors of the Institute of Tropical Agriculture of the University of Puerto Rico.

Dr. James H. Elder, of the department of psychology of the Louisiana State University, has leave of absence to enable him to serve as psychologist in the office of the chief signal officer of the War Department, Washington, D. C.

Dr. E. Raymond Hall, associate professor of vertebrate zoology of the University of California at Berkeley, has returned from a visit of two and a half months to Mexico, where he collected specimens and assisted in a survey of natural resources for the Mexican Government. Professor Hall brought back from the southern end of the tableland of Mexico 650 specimens of mammals, which included pocket gophers, skunks, opossums, weasels, mice and rats. The collection is said to be remarkable for the number of varieties, species and even genera which were found so close together.

Dr. Carl C. Lindegren, research associate, Washington University, gave a university lecture on "Breeding Yeast for the Wartime Diet" at the University of Illinois under the auspices of the Division of Biological Sciences and lectured on June 11 on the same subject before the staff of Dr. Tom D. Spies at the Hillman Hospital in Birmingham.

It is reported in *Nature* that the Council of the British Institution of Electrical Engineers has made the following awards of premiums: *Institution Premium:* C. J. Beaver and E. L. Davey; *Kelvin Premium:* Dr. F. Brailsford and R. G. Martindale; *John Hopkinson Premium:* R. A. W. Connor; *Non-Section Premiums:* Dr. E. Friedlander (Ayrton Premium), C. T. Melling (Llewellyn B. Atkinson Premium), J. Swaffield (extra premium); *Wireless Section Premiums:* Dr. R. L. Smith-Rose and Miss A. C. Stickland (Duddell Premium), G. Parr and W. Grey Walter (Ambrose Fleming Premium), Professor Willis Jackson (extra premium); *Measurements Section Premiums:* Lieutenant-Colonel K. Edgcumbe (Silvanus Thompson Premium), M. Kaufmann and W. Szwander (Mather Premium), G. H. Barker and A. L. Hancock (extra premium); *Transmission Section Premiums:* A. W. Thompson and J. C. Wood-Mallock (Sebastian de Ferranti Premium), A. A. Pollitt (John Snell Premium), H. Willott Taylor and K. L. May (extra premium); *Installations Section Premiums:* G. B. Alvey and N. Tetlow (Crompton Premium), Forbes Jackson, W. J. H. Wood, G. Smith and E. Jacobi (Swan Premium), J. R. Taylor and C. E. Randall (extra premium); *Paris Exhibition,* 1881, *Premium:* J. N. Waite.

The Amateur Astronomers Association, with headquarters at the Hayden Planetarium of the American Museum of Natural History, has established an award to be known as the Amateur Astronomers Medal to stimulate interest in astronomy and to commemorate the quadricentennial of the death of Copernicus. The medal will be given from time to time to an amateur astronomer or layman who performs an outstanding service to astronomy.

IT is reported in *The New York Times* that Arthur Curtiss James, railroad industrialist, who died on June 4, 1941, left a gross estate of $37,771,613 and a net of $34,771,702. Charitable, religious and educational institutions share $25,317,154, of which the James Foundation gets $23,030,387. The James Foundation, which was created to aid charitable, religious and educational institutions, will receive eight tenths of his residuary estate. In addition to this it also receives art and real estate worth $574,085 and remainder interests in trusts set up in his will valued at $1,202,682. Mr. James requested the foundation to aid institutions which he had helped during his lifetime. Among these are Amherst College, Hampton Normal College and the Tuskegee Normal and Industrial Institute.

ACCORDING to the *Harvard Alumni Bulletin,* gifts to the university for the year to the date of commencement amounted to $5,144,255, a million and a half larger than the total amount received over the preceding year. The gifts for immediate use ($1,078,574) were lower than for any year from 1933–34. But capital gifts of $4,065,681 were larger than for all except three years of the last ten; and of these the unrestricted gifts—the most valued and most needed by the university—amount to $3,320,884, or to more than the total unrestricted gifts for capital to the university in the eight years preceding. At the commencement ceremonies the marshal, David M. Little, presented to the university on behalf of the class of 1918 a check for $100,000.

THE Academia Nacional de Medicina of Buenos Aires has recently established the Hirsch Medical Scholarship with a fund of 500,000 pesos given by Alfredo Hirsch, of Buenos Aires. Selected students will follow medical studies in the United States or Great Britain for two years, beginning in the middle of 1943. For the first ten years the scholarships will be given for studies on cancer, leprosy and infantile paralysis.

THE San Diego Society of Natural History, whose museum in Balboa Park has been taken over by the U. S. Navy for hospital purposes, has been allowed to retain a considerable section of the ground floor, according to Clinton G. Abbott, director. Here the extensive study collections and departmental libraries have been gathered, and the research and publication activities of the staff are being continued. The main library has been moved to San Diego State College for the duration. The exhibits have been stored.

Nature reports that ten Chinese students, the first to visit Britain under a new scheme operated by the British Council, are now on their way to Great Britain. They have been given scholarships by the council, and will study some branch of engineering and will work at the university or college most suited to their special qualifications. Their training is expected to be of special value both because it will equip them for reconstruction work in China, and because their familiarity with British engineering practice and equipment will furnish a link between Great Britain and China.

DISCUSSION

THE CONCEPT OF CELLS HELD BY HOOKE AND GREW

REFERENCES to historical topics in current text-books of biology, botany and zoology can be counted in most cases on the fingers of one hand. In view of the decided lack of any historical approach, it seems rather anomalous that two concepts that are presented from this standpoint are so often either incorrect or distinctly misleading. The first of these—namely, that Schleiden and Schwann were the real originators of the cell theory and enunciated it before any one else—has been disproved in scholarly fashion by Karling.[1]

The second general error is a misunderstanding of the conception of the cell held by the early microscopists, especially by Robert Hooke and Nehemiah Grew. Almost all the biological text-books, including those of botany and zoology, if they refer to the topic at all, either state or imply that Hooke saw merely the *walls* of cork, pith and charcoal. To be sure, he did see the walls of such cells, and with his ineffective microscope, they must have stood out more clearly in such tissues than in living material.

However, Hooke was perfectly aware that cells in living plants had contents. This is stated very definitely in his "Micrographia," published in 1665. "But though I could not with my *Microscope,* nor with my breath, nor any other way I have yet try'd, discover a passage out of one of those cavities into another, yet I cannot thence conclude, that therefore there are none such, by which the *Succus nutritius,* or appropriate juices of Vegetables, may pass through them; for, in several of those Vegetables, whil'st green, I have with my *Microscope,* plainly enough discover'd these Cells or Poles fill'd with juices, and by degrees sweating them out: as I have also observed in green

---

[1] J. S. Karling, *Amer. Nat.,* 73: 517–537, 1939.

Wood all those *Microscopical* pores which appear in Charcoal perfectly empty of anything but Air."[2] Or again, in speaking "*Of* Petrify'd Wood," he remarked "and with a *Microscope,* I found, that all those *Microscopical* pores, which in sappy or firm and sound Wood are fill'd with the natural or innate juices of those Vegetables, in this they were all empty, like those of *Vegetables* charr'd."[3] Hooke mentioned repeatedly the "*Succus nutritius,* or natural juices of Vegetables"[4] and was definitely aware that cells in living plants had contents.

According to the preface of his well-known book on "The Anatomy of Plants," published in 1682, Nehemiah Grew began his study of the structure of plants in 1664. His work on plants was much more intensive than that of Hooke. No one can read the philosophical discussions and speculations of Grew and not be impressed by his concept of the plant as a whole, and of its functions, even though he was incorrect in many of his deductions. Grew discussed at considerable length the "Infinite Mass of little *Cells* or *Bladders*" of which the parenchyma of the root, for instance, is composed. He mentioned their size variations, their arrangement in rows—"they visibly run in Ranks or trains"—and their contents. "They are the Receptacles of *Liquor;* which is ever Lucid; and I think, always more Thin or Watery. They are, in all *Seed-Roots,* filled herewith; and usually, in those also which are well grown, as of *Borage, Radish,* etc."[5] In other places Grew referred to such "*Bladders*" as "fill'd with Sap"[6] and as "*Cisterns* of *Liquor.*"[7]

From these quotations it is evident that Hooke and Grew fully realized that cells in living plants had contents. Of course they had no knowledge of the internal structure and organization of the cell, of its nucleus and other constituent parts, of the protoplast as we know it to-day. They apparently did not appreciate the importance of the cell as a unit in the organism. However, they thought of liquids or juices moving within the plant through the cells, foreshadowing, unconsciously, much more recent work on hormones, vitamins, viruses and the translocation of substances in plants.

Hooke's use of the term cell is often condemned as a "biological misnomer" because the protoplasm is of course the important part rather than the wall. However, in justification it may be pointed out that in plant tissues, at least, the wall is of marked significance; and further, there is nothing either in the etymology of the word or in its use in ordinary parlance that requires that the cell be empty. The Romans used the word *cella* to refer—among other things—to the cell of a honeycomb or to a storeroom for wine, grain, oil, honey, etc. Certainly in such instances the contents were quite important.

In summary, Robert Hooke and his illustrious contemporary Nehemiah Grew knew that cells in living plants had contents; they did not think that they were merely "empty boxes."

EDWIN B. MATZKE

---

[2] R. Hooke, "Micrographia," p. 116, 1665.

[3] *Ibid.*, p. 107.

[4] *Ibid.*, also p. 114.

[5] N. Grew, "The Anatomy of Plants," Book II, p. 64, 1682.

[6] *Ibid.*, Book I, p. 25.

[7] *Ibid.*, Book III, p. 126.

THE HYDROLYSIS OF d-PEPTIDES

IT is by now well known that peptidases from many different sources can hydrolyze unnatural peptides containing a d-amino acid radicle. Cleavage proceeds more slowly than it does in the hydrolysis of corresponding compounds containing the l-isomer; Berger, Johnson and Baumann,[1] for example, find that peptidases from chick mucosa, yeast autolysate and malt can split d-leucylglycine about one thirtieth as rapidly as they split the racemic mixture. This is in accordance with the theory of steric hindrance, developed by Bergmann and his coworkers[2] to explain the fact that l-leucyl-d-alanine is split more rapidly than glycylglycine but less rapidly than l-leucyl-l-alanine by yeast dipeptidase and erepsin.

Evidence from different sources suggests that the presence of one isomer may interfere with the hydrolysis of the other. Thus Palmer and Levy[3] found that the presence of d-alanylglycine strongly inhibits the hydrolysis of the l-isomer by chick embryo extracts, although it is not itself hydrolyzed. On the other hand, Bamann and Schimke[4] find that the dipeptidase of human ovaries will hydrolyze d-leucylglycine but has little action on the d-isomer when dl-leucylglycine is used as substrate. Both Palmer and Levy, and Bamann and Schimke note that the reaction is inhibited by the products of hydrolysis.

It seems probable that the true explanation of these phenomena lies in the effect of the pH change which accompanies dipeptide hydrolysis.[5] In the alkaline range, the dissociation constants of the dipeptides concerned lie between 8.0 and 8.4, while those of the amino acids lie between 9.8 and 10.0. Even with moderate buffering there is a marked alkaline shift during hydrolysis, so that the pH of the digest rapidly passes beyond the optimum and inhibition of enzyme action ensues. In the experiments of Palmer and Levy the presence of the non-hydrolyzable d-isomer presumably gave better buffering and the assumption is that the pH of the digest never reached the optimum so that an apparent inhibition resulted. These authors state that the pH optimum was at 7.8, the pH at which they worked, but this is not in agreement with the results of Berger and Peters,[6] who found, with three different buffer systems, that the peptidase of the chick embryo had a pH optimum at about 8.5. The latter agrees well with the more alkaline pH optimum of the salamander dipeptidase.

---

[1] J. Berger, M. J. Johnson and C. A. Baumann, *Jour. Biol. Chem.*, 137: 389, 1941.

[2] M. Bergmann, L. Zervas, J. S. Fruton, F. Schneider and H. Schleich, *Jour. Biol. Chem.*, 109: 325, 1935.

[3] A. H. Palmer and M. Levy, *Jour. Biol. Chem.*, 136: 407, 1940.

[4] E. Bamann and O. Schimke, *Naturwiss.*, 29: 365, 1941.

[5] G. E. Pickford, *Jour. Exp. Zool.*, 92: 143, 1943.

Failures to detect hydrolysis of the d-isomer in racemic mixtures would result from the more rapid hydrolysis of the l-isomer which, when completely split, would carry the pH of the digest beyond the optimum so that continued slow hydrolysis of the d-isomer would be prevented. It is evident that conclusions with regard to the hydrolysis of d-peptides must not be based on the results of hydrolysis of racemic mixtures, a fact that has been overlooked by many authors, including myself.

GRACE E. PICKFORD

OSBORN ZOOLOGICAL LABORATORY,
YALE UNIVERSITY

U. S. TEXT-BOOKS FOR STUDENTS IN LATIN AMERICAN UNIVERSITIES

PRESENT SITUATION

MOST texts used for advanced study are French and Spanish, despite the expressed desire of many professors to use United States texts. Texts in English from the United States are not used because the texts are too expensive; the 5 to 1 ratio of exchange, with Mexico for example, makes an imported text there cost 25 pesos that costs 5 dollars in the United States. The texts referred to are mostly those used in such small numbers by advanced classes in specialized subjects that a Spanish translation will not pay for itself.

Yesterday I learned of one course in which the students this year at the Universidad Nacional de Mexico effectively objected to purchasing a 25 peso United States text assigned by their professor. He admitted (to them and to me) that they could not afford it. French and Spanish texts cost less in Mexico where potential volume of sales does not justify publication within the country itself of texts in specialized subjects.

Professors in Latin American universities find United States text-books superior for many courses because these books treat of American materials. For example, a botanical text from the United States in illustrating structure, physiology, etc., employs kinds of plants found in America, whereas the European texts and illustrations treat of unfamiliar kinds of plants characteristic instead of Europe and Asia.

REASONS FOR MAKING U. S. TEXTS AVAILABLE IN LATIN AMERICA

(1) Several professors in Latin America have expressed a desire for United States texts and the demand and plea is of constant growth.

(2) As already noted, some United States texts are best because they treat of American materials.

(3) Use of United States texts by Latin Americans in process of intellectual training is tremendously effective propaganda in that it brings fuller understanding of English-speaking Americans to the Latin Americans; evidence is provided of United States accomplishment in science, art and literature. This evidence needs to be placed in the record for the benefit of the many Latin Americans who heretofore have known principally of our accomplishment in material matters—typewriters, automobiles and dollars.

MEANS OF ACCOMPLISHMENT

(1) Learn precisely which text-books are desired and where and in what quantities. (2) Make these available at a cost within reach of the students for whom they are intended.

One United States professor in Mexico and Central America, and two or three in South America, by conference with university professors there, and with guidance from Cultural Relations representatives in United States Embassies, should most effectively obtain the requisite information.

The United States professors might well explain the rental system in use on campuses of some United States universities whereby for one course at a cost of only $1.00 a student has the use of a text-book which costs $7.50 new.

To make copies of these texts available at a price within reach of the Latin American students is a most worthy aim. It seems not unfair to place before the people of the United States the opportunity and responsibility for achieving this end.

Possibly no subsidy at all would be required, or at most a smaller one than at first thought would seem necessary, if Latin American students are as much interested in used copies as are United States students, many of whom obtain their copies at a fraction of the list price. Here is how the system operates:

Professor Torrey in 1941 adopted for his advanced course in biology the new text-book by the two authors Peralta and Smith. Each of 150 students in Professor Torrey's class was required to purchase a copy of the text, which cost $7.50. At the end of the course, 50 students retained their copies, but the other hundred students resold theirs to the local book-dealer at $2.00 each. In 1942, the 150 students in Professor Torrey's class rushed to purchase texts. "First come first served" is the rule. One hundred pupils purchased used copies at $3.75 each and the 50 pupils who arrived later purchased new copies at $7.50 each. In 1943, Professor Torrey will have possibly 50 pupils in all (the other hundred are in military service or war work—I had 8 instead of 80 in an autumn class) and the campus book-dealer has 50 extra copies that he is glad, indeed, to sell for $2.00 each. This is about the price which can be charged in Latin America.

---

[6] G. Berger and T. Peters, *Zeitschr. physiol. Chem.*, 214: 91, 1933.

We (the United States) should get busy now so as to have the texts at the places where they are desired at the opening of the new scholastic year in Latin American universities.

E. Raymond Hall

University of California, Berkeley,
Dated at Mexico, D. F., April 9, 1943

THE INSTITUTE OF TROPICAL AGRICULTURE AT TURRIALBA

The news item in the March 26 issue of Science relative to the foundation of the new Institute of Tropical Agriculture at Turrialba (Costa Rica) was read with considerable interest here, as we feel that the foundation of said institute represents a definite step forward. Turrialba is also an excellent location because it is there that the U. S. Department of Agriculture Rubber Field Station, directed by Dr. Theodore Grant, is located. Thus the newly announced rubber research program of the new agricultural institute will utilize both the experience and the disease-resistant material already developed by Dr. Grant and his staff. This represents a tremendous saving in time, precisely at the moment when time is the most important consideration.

The foundation of the agricultural institute is also of great value because it will contribute to giving both scientists and government officers in the United States a truer picture of the real conditions of the American tropics. But the greatest hope that some of us long-time residents of the Caribbean area see in the foundation of the new institute lies not so much in what it can do in the way of publishing pretty bulletins and reports or even in the development of improved plant varieties; but rather in the courage which it might display in facing some of the broader problems of tropical agriculture.

Consider, for example, the problem of fuel and power: Every one who has carefully studied the agricultural economics of countries like Costa Rica inevitably concludes that the scarcity and high price of fuels constitute the greatest single barrier against a real development of the country. Regardless as to whether we talk of railroad or automotive freight-rates or about the development of small local industries, we always come back to the painful fact that the only fuel locally produced is wood-fuel and that its continued use at anywhere near the present rate will soon create a terrific problem in forest depletion, soil erosion, irregular stream flow, etc. And thus we also inevitably reach the conclusion that any honestly conducted program of agricultural conservation and development in Costa Rica must first contemplate making available large blocks of cheap hydroelectric power, in order that the people shall not only have an inexpensive source of heat to cook with, but also that electrification be applied to such things as the small farm, the small rural industry and to all railroads in the country not already electrified. Furthermore, any honest-to-goodness program of tropical sanitation will have to dispose of large amounts of cheap chlorine for water disinfection and as the means of oxidizing the harmful residues of the coffee industry. This is intimately tied up with the cost of electricity, as chlorine is a product of the electrolytic cell.

The lands acquired by the Institute of Tropical Agriculture at Turrialba are located in the middle of a region rich in waterfalls which have never been developed because of the financial limitations of the province where Turrialba is located. But we already have an example in the nearby province of Alajuela, where there is a publicly operated electric plant that was built some fifteen years ago by a German-Swiss company. This plant has not only paid for itself, but has also demonstrated that electricity may be produced in the tropics at a fraction of the cost of even the so-called "yardstick" plants in the United States, like T.V.A. Likewise, the government-owned and -operated Ferrocarril Electrico al Pacifico offers another definite example of how a relatively modest investment in electrical transportation facilities pays back a thousand-fold in the tremendous agricultural development made possible on the Pacific sector of Costa Rica.

Considering the ease with which the new Institute of Tropical Agriculture could obtain the loan of technical talent from other Federal agencies, such as the T.V.A. or the Rural Electrification Administration, and the low interest rates at which projects sponsored by the Federal Government may be financed, it seems to the writer that the new institute has in its hand a brilliant opportunity to do some real progress in tropical agriculture if it could only muster the courage to abandon the beaten track and face the economic realities of the Turrialba valley. Naturally, the suggested course is not the easiest; as in order to put across the project, the institute might have to fight both private electric utilities and certain foreign-financed agricultural ventures in which the workmen are kept under the patriarchal conditions which prevailed in Europe during the Dark Ages. But then again, what ever really great institution has ever grown up by following the beaten track?

Furthermore, any endeavor that the agricultural institute can sponsor tending towards the more intelligent utilization of the natural resources of the Turrialba Valley will be supported by the common people of Costa Rica, who are as a whole industrious and literate.

RAFAEL W. KEITH

SAN JOSE, COSTA RICA

SCIENTIFIC BOOKS

METEOROLOGY

Harvard Meteorological Studies, No. 6. Heat Transfer by Infrared Radiation in the Atmosphere. By WALTER M. ELSASSER, Harvard University, Blue Hill Meteorological Observatory, Milton, Mass. 106 pp. Appendix, bibliography and copy of the Atmospheric Radiation Chart, second edition. 1942.

THIS publication comprises three parts, more or less independent, namely: Part I, "Principles of Radiative Transfer." Part II, "Structure and Absorption of Infrared Bands." Part III, "The Measurement of Atmospheric Emission." Then follows the Appendix, descriptive of a mechanical computing device, the Bibliography and the Radiation Chart.

Students of atmospheric radiation have been under deep obligation to Dr. Elsasser for several years on account of his excellent chart. Making use of additional observations and reconsiderations the chart has now been recomputed, and has undoubtedly become a far more trustworthy representation of the complex problem of atmospheric radiation. The author calls attention, however, to the need of much additional observation to cover many doubtful matters in this difficult field.

Part I begins with a demonstration of Kirchhoff's principle: "The ratio of emission and fractional absorption in any direction of a slab of any thickness in thermodynamic equilibrium equals the black body intensity." To this reviewer the author's demonstration lacks something of completeness. He considers a constant temperature enclosure with totally opaque walls, and shows that the second law of thermodynamics requires that the transfer of energy from one wall to the opposite must equal the return. He says: "Therefore, the emission of a perfectly opaque wall is generally independent of the optical properties of the wall." Suppose one wall was of soot and the opposite wall was of polished silver. The emission of the soot would be many times as intense as the emission of the silver. But within the enclosure by reflection, supplementing emission, the flux from the silver is built up to be the flux from an absolutely black body, and the same holds to a minor extent with the soot. Had this point been established and made clear, the author could have passed logically to his statement in the next paragraph: "We call I_b the intensity of this beam which, in thermodynamic equilibrium, is just the black body intensity." From this statement the Kirchhoff expression $E/A = I_b$ follows at once, as the author shows.

The author continues in Part I with Schwarzschild's equation of radiative transfer and its integration under the particular conditions which prevail in the atmosphere. Planck's law connecting temperature and frequency, Stefan's fourth power law for total radiation are considered, and a valuable table follows representing for the black body the integration of radiation intensity by wave number and the change of intensity with temperature.

Transfer of monochromatic radiation, and of non-monochromatic radiation are treated mathematically, bringing in, of course, the important exponential principle of Bouguer and Lambert and the relation: "For isotropic radiation the flux [total over a hemisphere] is π times the intensity of a straight beam," and developing an important set of functions useful in radiation transfer problems including the so-called recursion formula. These mathematical steps lead on to the general transfer problem of the flux emitted by an atmosphere of arbitrary constitution, and the first mention of the Atmospheric Radiation Chart.

And now observation comes to the fore with its showing of the special radiative and absorptive properties of water vapor, carbon dioxide, ozone and the permanent gases oxygen and nitrogen. The application of these properties in the Radiation Chart and the use of the chart for particular problems is discussed. The reviewer, however, believes that ordinary users of the chart would have appreciated several completely worked-out numerical applications of it to specific examples from actual observations. Something of this, indeed, is given in Table 2, but more extensive numerical examples would be helpful.

Two aspects of absorption in spectral lines, namely, broadening under pressure and Doppler effects of motion, are found to be of some importance concerning atmospheric radiation problems, and are treated by the author at considerable length. Then comes the discussion of overlapping spectrum lines in band spectra, ending in the derivation of a formula for band absorption in the most general case. Following is a reference to the effects of pressure and temperature on absorption coefficients of the atmospheric constituents.

Water vapor, as is well known, presents a very difficult problem in atmospheric radiation and absorption. Rapidly falling off with altitude, presenting many bands of line structure, subject to rapid and large changes of quantity from day to day, affected by both pressure and temperature in its absorption, effective in both solar and terrestrial spectral ranges, one might well fear that it would prove totally unmanageable in a chart. But several researches of great merit, referred to by the author in warm terms of appreciation, have furnished so considerable an experimental background that empirical formulae fairly representative of water vapor radiation and absorption have been derived. This part of the author's publication occupies 12 pages with several diagrams and tables.

Carbon dioxide and ozone compared to water vapor are simple problems and are briefly treated.

In Part III, instruments and methods for measuring radiation and absorption of atmospheric constituents are discussed at considerable length and with good discretion.

A brief description is given of the important instruments used for carrying out the extensive numerical calculations for the chart. Then follows a bibliography of 123 entries, and finally the highly valuable chart.

All those interested in atmospheric radiation researches will find Dr. Elsasser's publication timely and invaluable. No doubt as research goes on he will from time to time revise and improve it.

C. G. Abbot

Smithsonian Institution

ANOXIA

Anoxia: Its Effect on the Body. By Edward J. Van Liere. xiii + 269 pp. Chicago: University of Chicago Press. 1942.

The subject of oxygen deprivation, and its physiological and psychological effects, has assumed great importance in recent years in medicine and related fields. With the present war, this subject has become of increasing importance because of its role in high altitude flying in aviation. This timely review is more comprehensive than any other single work on this subject in the English language. It comprises a systematic presentation of the results of experimental studies in this field, arranged according to the physiological systems of the body.

Following a brief historical introduction, there is a short chapter dealing with the definitions of terms. The familiar classification of the various types of anoxia, according to Barcroft and to Peters and Van Slyke, is then given with a brief review of the physiology of respiration. The subject of cellular oxidation is but barely mentioned. Schmidt's classification of anoxia into the fulminating, acute and chronic varieties is then described. Here (p. 16) it should be pointed out that the term "chronic anoxia" should not be used in a sense almost equivalent to "chronic mountain sickness" as necessarily resulting in adverse symptoms. Permanent residents of high altitudes live in a condition of chronic or constant anoxia and most of them, at least up to a certain altitude, do not show signs or symptoms related to oxygen want. There follows a chapter on the experimental methods of producing anoxia. In appraising the various methods (p. 27) the author fails to bring out the fact that with the rebreather, the degree of anoxia progressively increases at such a rapid rate, and the duration of an experiment is therefore so short as to enable the subject to compensate for the effects by exerting extra effort for a short time until the final stages of deterioration. During the first World War, the rebreather tests resulted in a false impression as to the altitudes at which aviators could remain for any length of time and still maintain their physical and mental capacities. Experiments of longer duration reveal a much lower "ceiling" for the average pilot or unacclimatized subject.

The remaining chapters deal with the effects of anoxia on the various physiological systems, beginning with the morphology and chemistry of the blood, the circulatory system, with separate chapters on blood pressure and on the lymph. In the chapter on the effects of anoxia on the blood, the author points out the necessity for distinguishing clearly between "oxygen content" and "oxygen capacity" of the blood. He erroneously states, however (p. 52), that "In Keys's group the oxygen *content* of the blood increased an average of 25 per cent." It was actually the oxygen *capacity* which increased.

In several cases in which more than one factor is involved the author does not bring out the exact role played by each variable. Thus in his discussion of the changes in alveolar pCO_2, pO_2 and arterial O_2 content at high altitudes (p. 102), the author does not clearly distinguish between the effect of (a) increasing ventilation on lowering the alveolar pCO_2 and concurrently increasing the alveolar pO_2 and of (b) the Bohr effect, which leads to a greater O_2 content of the blood when the arterial pCO_2 is decreased but the arterial pO_2 is held constant. He tries to cover the whole situation merely with the Bohr effect, which *per se* has nothing to do with alveolar pressures.

The following chapters deal with mountain sickness, altitude sickness and acclimatization. In comparing the effects of acclimatization to oxygen want with acclimatization to carbon dioxide, the author states (p. 155) that certain similarities are to be expected since "in both cases there is some increase in tissue acidity." It is very questionable whether anoxia, unless it be of very serious degree, gives rise to tissue acidity; on the contrary, the increase in pulmonary ventilation results in "blowing off" of CO_2 and thus a decrease in acidity of the body fluids.

Probably the most complete and authoritative part of the book is the chapter dealing with the effects of anoxia on the digestive tract. The author himself and his co-workers have studied this subject quite intensively over a period of years.

The remaining chapters deal with the secretion of urine, the endocrine glands, metabolism, heat regulation, nutrition, water distribution in the body and the nervous system.

In the last chapter the author discusses the physiological effects of anoxia on the nervous tissue, its circulation and function. This is followed, without adequate integration, by a discussion of the psychological effects of anoxia. This section, as the author admits, is especially lacking in detail and completeness of bibliography. The most interesting observations in this field relate to the striking and insidious changes in behavior produced by a lack of oxygen to the nervous tissue. The author fails to interpret the intimate relationship which must exist between an adequate and constant supply of oxygen to the nervous tissue and mental functions, such as memory, judgment and reasoning, which are essentially psychological in nature. This is important, not only from the point of view of research relating to the possible cause of certain mental disorders, but also in an understanding of the very foundation of mental processes or behavior in general.

The discussion of the visual effects is particularly sketchy and incomplete. Little attempt is made to interpret the role of these findings in an understanding of the nature of the visual mechanism itself. Several errors in this last chapter might be pointed out. Psychological tests, such as speed of apprehension, memory tests and repetition of auditory patterns, commonly termed mental tests, are erroneously referred to as "psycho-somatic tests" (p. 234). In reporting the various studies on sensory function, the expression "decrease in threshold" is used where "increase" is obviously meant (pp. 244, 246).

The author might have emphasized more clearly that the great variations found in the responses and adaptive processes to anoxia are not only related to the type of stimulus (acute, intermittent, chronic) but are also attributable in great part to the different *degrees* of anoxia used in experiments and found at different levels of altitude.

The chief criticism concerning the style in which this monograph was written is that frequently mere statements of experimental results are given, without mention of the methods employed by the investigators, or critical appraisal of other factors which might be of value in judging their validity. This deficiency is noted particularly when opposing experimental results are cited. More interpretation and integration of the findings of the various investigators would have improved this monograph.

For the reader who is not familiar with the literature, this monograph provides a valuable summary. It is, however, not as complete in its bibliography as might be desired. A number of important studies are omitted which would have assisted the author in interpreting several controversial topics. In the section on hematology, for example, the important paper by Talbott (1936) from the International High Altitude Expedition is not mentioned. Also, a great part of the work done in Peru has been neglected. It seems regrettable that Hoff and Fulton's more complete and excellent "Bibliography of Aviation Medicine," also published in 1942, was not available to Dr. Van Liere during his preparation of this book. Also the lack of an authors' index in a work of this kind is unfortunate.

The need for a current book reviewing the work done on this subject has been very great. In spite of the above criticisms, Dr. Van Liere's monograph serves as a useful introduction to the literature on the physiology of oxygen deficiency. It will be of value not only to research workers in physiology and psychology, but also to those concerned with the problems of high altitude in aviation. The clinician, as well, will find it of interest in view of the role of anoxia in various diseases.

ROSS A. MCFARLAND

HARVARD UNIVERSITY

SPECIAL ARTICLES

ABOLISHMENT OF ALIMENTARY LIPEMIA FOLLOWING INJECTION OF HEPARIN

DURING the course of determining red cell circulating mass in dogs by the donor-isotope red cell procedure, an occasional animal of irregular eating habits showed a marked lipemia in the initial control blood sample. When injected with whole blood containing tagged cells, in the instances in which heparin was used as an anticoagulant, this lipemia had disappeared completely in the blood sample taken three to five minutes later. This phenomenon was so striking, even in the instances where the degree of lipemia was such that the plasma was suggestive of light cream, that it seemed advisable to determine how specific the reaction might be, ruling out any special donor-recipient peculiarities which might be responsible for the change.

In the first experiments the lipemia was due to the dilatory eating habits of the animals. Later, in order to be able to depend on the presence of lipemia the food was not given in the afternoon as usual but reserved until morning, or sometimes an extra meal consisting of 100 gms each of salmon bread, Klim and cod liver oil was fed from two to four hours before sampling.

Both blood samples were taken from the same jugular vein, the needle being left in place. The injected material was also introduced through this needle. The degree of lipemia was not quantitated except roughly as follows: 0 – water clear plasma; 1 + – slight turbidity; 2 + definite lipemia; 3 + sufficient lipemia to obscure the meniscus of the plasma completely; 4 + – same as 3 + but with frank lipid layer on top the plasma layer.

In Table 1 is shown a series of reactions in which heparinized whole blood from a number of donor dogs was injected, as well as plasma from heparinized blood. Two makes of heparin were used, those experiments marked with * were carried out with a preparation obtained from the Hynson and Westcott Company of Baltimore, while those marked ** were done with material of considerably greater specific potency (1 mgm = 110 units) obtained from the Connaught Laboratories of Toronto. In all experiments in which heparinized whole blood or plasma was administered the lipemia was abolished. The reaction did not occur on the injection of washed red cells derived from heparinized blood nor after injection of any fractions derived from citrated blood.

It was finally found that the same amount of heparin (**2.4 mgm) as used in the earlier experiments when dissolved in saline and given by vein would in itself abolish the lipemia.

Addition of 5 mgm of heparin to 5 ml of lipemic plasma *in vitro* with mixing showed no reaction on standing. Neither did mixing of heparin with nonlipemic plasma and subsequent mixing with lipemic plasma result in the clearing of the latter.

The time interval of 5 minutes elapsing between the injection of the heparinized material and sampling is more than necessary for the reaction to occur. In three of the experiments shown in Table 1, samples were taken at ½, 1, 1.5, 2 and 3 minutes as well as 5 minutes. In each of these instances the lipemia was practically absent in the recipient's blood at the end of 1 minute.

TABLE 1

LIPEMIA BEFORE AND AFTER ADMINISTRATION OF HEPARIN

Date	Dog		Material introduced	Degree of lipemia		Donor source
				Initial	Final	
1/8	40–115	*	20 ml heparinized whole blood	3 +	0	39–266
1/20	41–104	**	" " " "	3 +	0	1–J
1/19	1–J	**	" " " "	3 +	0	39–206
1/4	1–K	*	" " " "	3 +	0	39–266
1/8	1–K	*	" " " "	4 +	0	39–266
1/19	40–115	**	20 ml heparinized plasma	2 +	0	1–J
1/19	41–164	**	" " "	4 +	0–1 +	39–266
1/22	39–266	**	" " "	4 +	1 +	38–137
1/20	39–196	**	" " "	4 +	0–1 +	40–149
1/13	1–J		20 ml citrated whole blood	2 +	2 +	pooled
1/13	38–137		" " " "	3 +	3 +	"
1/18	39–196		" " " "	3 +	3 +	39–266
1/13	40–115		25 ml citrated plasma	4 +	4 +	pooled
1/14	39–57		" " "	4 +	4 +	"
1/22	39–266	*	20 ml washed heparinized cells	4 +	4 +	38–137
1/19	40–149	*	" " " "	3 +	2 +	39–266
1/13	1–K		25 ml citrated washed cells	2 +	2 +	pooled
1/18	1–K		" " " "	4 +	4 +	"
1/23	40–115	**	20 ml citrated plasma (itself lipemic) to which was added 250 units of heparin	2 +	0	39–266
1/23	41–164	**	250 units of heparin in 5 ml saline	2 +	0	....
2/11	39–57	**	" " " " " " " "	4 +	0	....
1/28	40–115	**	" " " " " " " "	1 +	0	....
2/1	38–137	**	" " " " " " " "	3 +	0–1 +	....
2/11	39–266	**	" " " " " " " "	3–4 +	0	....

On a basis of the data presented here it would not be wise to speculate as to the nature of the mechanism involved in the abolishment of lipemia from the blood of dogs as a result of the injection of moderate amounts of heparin. Fractional lipid analyses of plasma taken before and after injection of heparin are being carried out and will be reported at a later date.

PAUL F. HAHN

UNIVERSITY OF ROCHESTER SCHOOL
OF MEDICINE

PRODUCTION AND TREATMENT OF GRANULOCYTOPENIA AND ANEMIA IN RATS FED SULFONAMIDES IN PURIFIED DIETS

THE production of granulocytopenia and anemia in rats through the use of sulfanilylguanidine or succinyl sulfathiazole in purified diets and treatment of the animals with whole dried liver or liver fractions have been reported from this laboratory.[1] The present study concerns the production and treatment of similar blood dyscrasias in rats receiving sulfathiazole, sulfadiazine or sulfanilamide.

---

[1] S. S. Spicer, F. S. Daft, W. H. Sebrell and L. L. Ashburn, *Pub. Health Rep.*, 57: 1559, 1942.

PRODUCTION

Albino rats were weaned at 21 to 27 days and placed on one of two experimental diets. One hundred and one rats were given a diet composed of glucose ("Cerelose") 72 per cent., "vitamin-free" Smaco casein 18 per cent., cod liver oil 2 per cent., cottonseed (Wesson) oil 3 per cent., salt mixture No. 550[1] 4 per cent. and either sulfathiazole, sulfadiazine or sulfanilamide at a level of 1 per cent. Twenty-six additional rats received one of these three sulfonamide drugs in a similar diet, except that it contained 25 per cent. Smaco casein and 65 per cent. glucose ("Cerelose"). Each rat received a daily supplement of 100 micrograms of thiamine hydrochloride, 200 micrograms of riboflavin, 100 micrograms of pyridoxine hydrochloride, 200 micrograms of calcium pantothenate, 1 mg of niacin and 10 mg of choline chloride. The rats were weighed three times weekly and after weight gain had ceased or when the animals appeared sick, blood counts were made and in some of the animals were repeated at irregular intervals. The techniques were the same as those previously employed.[1] The term "blood dyscrasia" is used in this report to denote a "severe granulocytopenia" or a "severe anemia" or both combined. "Severe granulocytopenia" is used to indicate a total polymorphonuclear granulocyte count of less than 150 cells per cu mm. The term "severe anemia" is used to indicate hemoglobin or hematocrit values of less than 7.5 grams per 100 cc or 25 cc per 100 cc, respectively. Milder degrees of granulocytopenia and anemia are not considered in this report.

From the data obtained, no marked differences have been noted between the incidence of blood dyscrasias in the rats given 18 per cent. Smaco casein and those given 25 per cent. Smaco casein in these diets; also the response to treatment has been similar. The data concerning both groups therefore have been considered together. Of the 127 animals on experiment, 22 were excluded from consideration because they died without blood counts having been made. Fifty-two animals developed a blood dyscrasia. The remaining 53 animals not showing such severe blood changes have been under observation from 99 to 169 days. Twenty-one of these animals have died and the remaining 32 have been sacrificed. Blood dyscrasias have been found as early as the tenth experimental day and as late as the eighty-sixth. The data in Table I do not include less severe degrees of granulocytopenia and anemia which were observed frequently.

It is to be noted that under these experimental conditions, the incidence of blood dyscrasias was very much less in the sulfanilamide group than in either the sulfathiazole or sulfadiazine groups. For these groups of animals the incidence of severe granulocytopenia was greater in those receiving sulfathiazole than in those receiving sulfadiazine, while the reverse was true of the incidence of severe anemia. Blood smears from severely anemic animals usually revealed marked abnormalities in the size, shape and staining reactions of the red blood cells and an increased number of nucleated forms. In the animals with severe granulocytopenia, a leucopenia with a mean value of about 4,000 cells per cu mm was usually present.

TABLE I

THE OCCURRENCE OF SEVERE GRANULOCYTOPENIA AND ANEMIA IN RATS INGESTING A SULFONAMIDE-CONTAINING, PURIFIED DIET

Sulfonamide contained in the diet	Total number of rats studied	Number of rats with a blood dyscrasia (severe granulocytopenia or severe anemia or both)	Number of rats with a total polymorphonuclear granulocyte count of 0–150 cells/cu mm	Number of rats with a hemoglobin or hematocrit of less than 7.5 gms/100 cc or 25 cc/100 cc respectively
Sulfathiazole	34	28	22	10
Sulfadiazine	36	22	9	16
Sulfanilamide	35	2	2	1

TREATMENT

Of the 52 animals that developed a blood dyscrasia, 30 were not treated and died. Of the remaining 22 animals, 17 were treated for a severe granulocytopenia, four for a severe anemia and one for both conditions combined. Fifteen of the 18 animals with granulocytopenia[2] were treated by the daily oral administration of 1 cc of an aqueous suspension containing 0.25 gm per cc of Wilson's solubilized liver,[3] or smaller amounts of more refined liver fractions; three were given a daily oral supplement of 1 gm of whole dried brewers' yeast. The treatment period was four days, during which time the animals continued to eat the sulfonamide-containing diet. Counts were made immediately before treatment and again at the end of four days of treatment. Five of the liver-treated animals failed to survive for more than three days. Recounts of the 13 animals which did survive the treatment period revealed a significant response in every instance. Table II contains the values for the liver-treated group before and after treatment. Five rats were severely anemic and four of them[4] were treated with 1 cc of Wilson's solubilized liver suspension for each of 10 successive days. The data for these animals are given in Table II, and as noted all showed some response at the end of five days; near normal levels were observed after 10 days of treatment. The one anemic animal not included in the table had an initial hemoglobin value of 6.5 gms per 100 cc. After 10 days of treatment with another fraction, it had fallen to a level of 2.3 grams per 100 cc, the hematocrit remaining unaltered at 18 cc per 100 cc. Treatment with the suspension of Wilson's solubilized liver was then given for 12 days. The hemoglobin level rose to 11.5 grams per 100 cc and the hematocrit to 56 cc per 100 cc. All the 14 animals treated with liver fractions and the three treated with brewers' yeast showed a resumption of growth and a marked clinical improvement.

---

[2] The animal with granulocytopenia and anemia combined is included here.

[3] Furnished through the courtesy of Dr. David Klein, Wilson Laboratories.

[4] The animal with granulocytopenia and anemia combined is included here.

TABLE II

BLOOD VALUES SHOWING A RESPONSE OF SEVERELY GRANULOCYTOPENIC OR ANEMIC RATS TO TREATMENT WITH LIVER FRACTIONS

	Number of experimental rats	Before treatment		Number of days of treatment	After treatment		Normal values cited in literature	
		mean	range		mean	range	mean	range
Total polymorphonuclear granulocytes per cu mm	10	29	0–103	4	3,203	1,550–5,760	3,465	1,200–6,825
Percentage of polymorphonuclear granulocytes		0.8	0–3	4	30.1	21–41	29.9*	15–45.5*
Total white blood cells per cu mm		3,808	550–7,320	4	10,550	4,950–16,950	11,590*	8,000–15,000*
Hemoglobin in gms per 100 cc	4‡	7.0	6.4–7.4	5	9.1	8.2–9.7	15.6*	14.0–17.2*
				10	13.6	13.0–14.1		
Red blood cell volume (Hematocrit) in cc per 100 cc		24	21–27	5	35	33–39	50†	....
				10	45	41–47		

* R. A. Scarborough, *Yale Jour. Biol. and Med.*, 3: 267, 1931.

† A. J. Creskoff, T. Fitz-Hugh, Jr., and E. J. Farris, in "The Rat in Laboratory Investigation," edited by J. G. Griffith and E. J. Farris, p. 351. Philadelphia: J. B. Lippincott Co., 1942.

‡ One additional animal is discussed in the text.

The mechanism of action of the sulfonamide drugs in producing these blood dyscrasias as well as other toxic manifestations is obscure. It has been suggested[1] that there may be an indirect toxicity such as an interference with tissue enzyme systems. Also, the possibility was considered that such an indirect toxicity, a direct toxicity and a reduction of intestinal synthesis of essential factors might all be involved.

SUMMARY

(1) A severe granulocytopenia or anemia, or both, have been produced in rats fed sulfathiazole, sulfadiazine or sulfanilamide at a 1 per cent. level in purified diets.

(2) Treatment with certain liver fractions orally has succeeded in correcting the granulocytopenia in four days and the anemia in about 10 days in spite of continued ingestion by these animals of the sulfonamide-containing diet.

ARTHUR KORNBERG
FLOYD S. DAFT
W. H. SEBRELL

NATIONAL INSTITUTE OF HEALTH,
U. S. PUBLIC HEALTH SERVICE,
BETHESDA, MD.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE DETERMINATION OF CELL VOLUME AND HEMOGLOBIN ON THE SAME DROP OF BLOOD

AN adequate clinical description of the erythrocytes in blood requires the determination of the cell volume, the hemoglobin content and the cell count.

A method for determination of cell volume, called the cell opacity method, has been described recently.[1] It involves the measurement in a photoelectric colorimeter of the transmission of light at a wave length of about 660 mμ through a suspension of blood in citrate solution. The cell opacity thus recorded is proportional to the cell volume, which can be read from a line or table showing this relationship. This method requires only 5–25 cmm of blood.

A method for the determination of hemoglobin by the measurement in a photoelectric colorimeter of the transmission of light of about 540 mμ has been described by Evelyn.[2] This determination requires a similar amount of blood.[3]

---

[1] A. T. Shohl, *Jour. Lab. and Clin. Med.*, 25: 1325, 1940.

[2] K. A. Evelyn, *Jour. Biol. Chem.*, 115: 63, 1936; also K. A. Evelyn and H. T. Malloy, *ibid.*, 126: 655, 1938.

It is convenient to make both measurements on the same sample of blood. After the cell opacity has been determined, the blood is hemolyzed and the hemoglobin quantitated with only a slight modification of Evelyn's technique. The blood is hemolyzed by the addition of one drop of saponin solution to the red cell suspension. Merck's saponin has been found to be satisfactory, but different samples have different degrees of activity and deteriorate at different rates. We have used an aqueous solution containing approximately 5 gm of saponin made up to 10 cc. It will retain its efficacy for 3–4 weeks or longer if kept in the refrigerator. The criterion of its adequacy is that one drop should hemolyze the blood and give a clear solution in less than one minute. The oxyhemoglobin thus obtained is made alkaline by the addition of one drop of concentrated ammonia (20 per cent. ammonia gas). Saponin and ammonia are added to the blank containing citrate solution only, and the colorimeter adjusted with a filter transmitting light at or near 540 mμ. The tube containing the sample is then inserted in the colorimeter and the galvanometer reading is interpreted in terms of hemoglobin concentration.[3] Parallel determinations by Evelyn's method and by this variation of it give the same values for hemoglobin.

This method uses such a small amount of material and is so easy to carry out that it may be surmised that accuracy has been sacrificed to convenience. Such is not the case. Each of the methods has been checked, the cell opacity against the hematocrit method and the hemoglobin against the oxygen capacity method. The results obtained show no greater errors than the standards against which they were compared.

To obtain maximum accuracy it is necessary to have carefully calibrated pipettes. However, if the readings of duplicate or multiple determinations made with different pipettes on aliquots of the same blood *in vitro* are not in agreement for the cell opacity, it will be found that the values for the amount of hemoglobin show corresponding variations. Each pair of determinations shows the same relationship because they are made on the same sample, regardless of its size. Thus, even if the pipettes are inaccurate, the relationship between the cell volume and hemoglobin concentration is accurately shown, and for some purposes it is more important to know the relative than the absolute values. Furthermore, two samples of capillary blood taken from the same individual may contain different amounts of plasma, tissue fluids and corpuscles. This source of error in sampling also is eliminated by the combined method.

Attempts have been made to use the transmission of light through a cell suspension for erythrocyte count with the Evelyn colorimeter[4] or the Exton scopometer.[5] These methods have been unsuccessful[6] in so far as they give approximately correct values only when the cells are of constant and normal size. It is primarily the total mass of cells and only secondarily their size which determines the amount of light transmitted.[7] This is shown clearly in the example of rat blood, which gives values similar to those of human blood for cell opacity and has a similar cell volume, but a cell count nearly twice as high.[8] However, if dealing with physiological conditions in which the size of the cells does not vary, the cell opacity gives a correlation with cell count as well as with cell volume.

Most physicians are more familiar with the clinical interpretation of cell count than of cell volume. The erythrocyte count as obtained by the cell opacity method may be used as an approximation for orientation, assuming the cells to be of normal size. For an accurate description of the erythrocytes in blood a cell count should be done in conjunction with the determination of cell volume and hemoglobin content. For the latter two the combined method given above has proved to be simple, accurate and economical of both time and material.[9]

ALFRED T. SHOHL
LOUIS K. DIAMOND

DEPARTMENT OF PEDIATRICS,
HARVARD UNIVERSITY

---

[3] The full technique for use of the photoelectric colorimeter is described in the manual which is supplied with both the Evelyn and the Klett-Summerson colorimeters.

[4] R. V. Christie and K. A. Evelyn, *Jour. Clin. Invest.*, 13: 704, 1934.

[5] W. G. Exton, *Am. Jour. Clin. Path.*, 7: 42, 1937.

[6] Unpublished data of Dr. G. M. Guest.

[7] D. Drabkin and R. B. Singer, *Jour. Biol. Chem.*, 129: 739, 1939.

[8] A. T. Shohl, K. D. Blackfan and L. K. Diamond, *Proc. Soc. Exp. Biol. and Med.*, 45: 383, 1940.

[9] Recent notes by F. T. Hunter, *Jour. Clin. Invest.*, 19: 691, 1940, and D. H. Duffie, *Jour. Am. Med. Asn.*, 119: 493, 1942, have shown the possibility of substituting sodium carbonate for ammonia. This procedure recommends itself in a laboratory where nitrogen determinations are being made. At present we add 1 drop of 5 per cent. sodium carbonate instead of ammonia.

GROWTH OF ORCHID SEEDS AFTER DEHYDRATION FROM THE FROZEN STATE

CERTAIN orchid seeds have germinated after eight and even fourteen years[1] when stored under optimum conditions, that is, in dry air at 46° F. In general, however, their lifespan is considerably shorter. A method which has proven outstandingly successful in the preservation of such biological materials as bacteria, filterable viruses and serum proteins is that of desiccation from the frozen state. It was thought to be of both practical and theoretical interest to determine, firstly, whether orchid seeds could survive and

[1] L. Knudson, *Amer. Orchid Soc. Bul.*, 9: 36–38, 1940.

grow after subjection to this process; and secondly, if so, whether the lifespan was increased. This paper reports the survival and growth of orchid seeds when vacuum dried after freezing at low temperatures.

A miniature, "lyophile" apparatus[2] described by Flosdorf and Mudd[3] was used, and with slight modifications the procedures outlined by these authors were applied to orchid seeds. The seeds used were the results of two primary crosses, *Cattleya Loddigesii* crossed upon *Cattleya Schroederiana* and *Laelia anceps* crossed upon *Cattleya Trianaei*. These species are natives of either Brazil, Colombia or Mexico and grow in climates where freezing temperatures are unknown or unusual.

In comparison with seeds of most flowering plants, those of orchids are very small. The ones used in this experiment measured on an average 527.7 μ by 73.5 μ. They had been stored for 7 months in a glass jar in a refrigerator. Their moisture content was not determined before they were "lyophiled" nor after, at the time of planting. The percentage of moisture in seeds of another cross stored in the refrigerator under similar conditions for 4 months has been found to be 1.5 per cent. The residual moisture which Flosdorf and Mudd found remaining in bacterial preparations after subjection to the "lyophile" process was 0.5 per cent.[3]

Two sets of tubes were prepared for desiccation. In one, sterile blood serum (commonly utilized in the preservation of bacteria by this method) was used as the suspending fluid and in the other, autoclaved coconut liquid. A mass of seeds which would approximate two drops of water in volume was placed in each tube. The tubes were plugged with sterile cotton and thoroughly agitated so that the seeds became completely coated with the liquids. This required some manipulation, for, due to the structure of orchid seeds, the outer alar cells resist wetting. The tubes were plunged into the dry ice bath of the main condenser of the apparatus at a temperature of −78° C. for about three minutes until thoroughly frozen. They were then attached to the vacuum manifold, being kept immersed at the same time in a dry ice bath maintained at −5° to −10° C. The vacuum pump was started and dehydration allowed to proceed for three to four hours. At the end of the second hour, the tubes were removed from the cold bath and held at room temperature. They were sealed off while under vacuum with an oxygen flame. These procedures (using the same volume of suspending fluid, degree of vacuum and time of desiccation) had given consistently satisfactory results with this apparatus in the preservation of bacteria.

Half of the tubes were stored for future tests of viability. The other half were broken open and the contents planted. Following Knudson's technique[4] for growing orchid seeds non-symbiotically, they were planted aseptically on a nutrient agar medium using a slightly modified Knudson's Solution B[4] with sucrose as the sugar and the pH 6.3. Some of the contents of the tubes were planted directly from the tubes while others were first sterilized with hypochlorite solution after Wilson's method.[5] No immediate contamination resulted from either of these procedures.

None of the seeds which had been immersed in blood serum germinated. All but one tube of those suspended in coconut liquid not only germinated but, with the exception of a few flasks which later became contaminated, grew satisfactorily. One flask containing seeds of *Cattleya Loddigesii* crossed upon *Cattleya Schroederiana* germinated within the short period of seven days, which was four days before the controls showed signs of germination. After four months, most of the seedlings had two leaves and one or two roots and were sufficiently large to remove from the containers and plant into community pots.

Although various kinds of seeds have survived exposure to low temperatures after varying degrees of drying,[6] to our knowledge this is the first time that seeds have been subjected to the "lyophile" process and have grown. Seeds of the tuberous begonia and snapdragon, which are roughly 2 to 10 times the size of orchid seeds, were similarly treated but failed to survive and grow.

RUTH DOWELL SVIHLA
UNIVERSITY OF WASHINGTON
ELIZABETH OSTERMAN
U. S. PUBLIC HEALTH SERVICE[7]

---

[2] Made available through the courtesy of the Department of Bacteriology at the University of Washington, Seattle, Wash.

[3] E. W. Flosdorf and S. Mudd, *Jour. Immunol.*, 29: 389–425, 1935.

[4] L. Knudson, *Bot. Gaz.*, 73: 1–25, 1922.

[5] J. K. Wilson, *Amer. Jour. Bot.*, 2: 420–427, 1915.

[6] B. J. Luyet and P. M. Gehenio, *Biodynamica*, Normandy, Missouri, 1940.

[7] Formerly with the University of Washington.

BOOKS RECEIVED

COLEMAN, LAURENCE VAIL. *Company Museums.* Illustrated. Pp. viii + 173. American Association of Museums. $2.50.

FREEMAN, FRANK N. and M. A. WENGER. *The Chicago Mental Growth Battery.* Illustrated. Pp. v + 58. The University of Chicago Press. $1.00.

JOHNSON, WILLIAM H. and LOUIS V. NEWKIRK. *Fundamentals of Electricity.* Illustrated. Pp. x + 212. Macmillan. $2.00. *Fundamentals of Shopwork.* Illustrated. Pp. viii + 200. Macmillan. $2.00.

LUCK, JAMES MURRAY. *Annual Review of Physiology.* Pp. vii + 613. Annual Reviews, Inc. $5.00.

SARGENT, PORTER. *War and Education.* Pp. 506. Porter Sargent. $4.00.

TULEEN, LAWRENCE F., GEORGE S. PORTER and ARTHUR HOUSTON. *Prepare Yourself.* Illustrated. Pp. vi + 208. Scott, Foresman and Company. $0.96.

SCIENCE

VOL. 98 FRIDAY, JULY 9, 1943 No. 2532

Recollections of a Street Corner Pump and the Progress of Sixty Years: PROFESSOR YANDELL HENDERSON 25

Initiative in Research: DR. COLIN GARFIELD FINK 28

Obituary:
- *William Francis Magie:* PROFESSOR E. P. ADAMS. *Recent Deaths* 31

Scientific Events:
- *The Enrichment of White Flour; Award of Guggenheim Fellowships; Awards of the Social Science Research Council; Foreign Members of the Royal Society, London; Medical Fellowships of the National Research Council* 32

Scientific Notes and News 35

Discussion:
- *Implications Involved in Mathematical Advances:* PROFESSOR G. A. MILLER. *An Unrecorded Cause of "Red Water":* DR. WALDO L. SCHMITT. *The Teaching of Tropical Medicine:* PROFESSOR HARRY L. ALEXANDER, DR. ROBERT A. MOORE and W. BARRY WOOD, JR. *The Elgin Botanic Garden:* J. BRETT LANGSTAFF 38

Scientific Books:
- *Nicholas Copernicus:* FREDERICK E. BRASCH. *The Electron Microscope; Radioactivity:* DR. W. F. G. SWANN. *Natural Coloring Matters:* DR. MARSTON TAYLOR BOGERT 40

Special Articles:
- *Human Complement:* DR. E. E. ECKER and OTHERS. *Pigment Production by Sulfonamide-Resistant Staphylococci in the Presence of Sulfonamides:* DR. WESLEY W. SPINK and JEAN JERMSTA VIVINO. *Intra-Ocular Virus Infections:* DR. CHARLES A. EVANS and OTHERS 43

Scientific Apparatus and Laboratory Methods:
- *Preparation of Methionine and Tryptophane-Free Casein Hydrolysates:* DR. ANTHONY A. ALBANESE 46

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

RECOLLECTIONS OF A STREET CORNER PUMP AND THE PROGRESS OF SIXTY YEARS[1]

By Professor YANDELL HENDERSON
YALE UNIVERSITY

THESE recollections center about an old pump on a street corner and some of the boys who used it: particularly one of the boys, Simon Flexner by name. The pump was on the southeast corner of Chestnut and Sixth Streets; the time was about sixty years ago, when I was nine or ten years old, and Simon Flexner just ten years older. Any city of our Midwest or South would do as well; but in fact the place was Louisville, Kentucky. This pump was merely the trunk of a tree—virtually a piece of telegraph pole with its center bored out—stood up in a well. A long curved metal arm with a knob on the end stuck out to the side and was worked up and down, first merely sucking air and then causing a flow of clear, cool and rather pleasant-tasting water. Hanging by a chain was a large metal dipper; it was so green with mold that in drinking from it I preferred to apply my lips to the edge close to the long handle. We children liked the pump and the water and the dipper, for in warm weather we could not only drink copiously but also dabble our bare feet in the splash and stream as the water ran off into the gutter or drained back into the well. There is no analysis of this water on record; nor were any bacterial cultures ever made from the dipper. But the following will give an idea of what might have been found if such an examination had been made and what Simon Flexner survived—for the good of humanity.

---

[1] This sketch is written as a testimonial to Dr. Simon Flexner, emeritus director of the Rockefeller Institute for Medical Research, on the occasion of his eightieth birthday.

The well below the pump was perhaps fifteen or twenty feet deep. The street was paved merely with a porous water-bound macadam, and there was no sewer, but only surface drainage. Any liquid in the gutter must in part have soaked into the subsoil and so have found its way into the well. But more important is the fact that not a hundred feet away from the well, in the backyard of the second building from the corner, was a cesspool. It was walled with brick and lime mortar, and as it was in constant use by a considerable number of people, it is as certain as the results of similar conditions elsewhere can make it that an appreciable seepage from the cesspool to the well went on continually.

Even this is not the full indictment of that pump and its dipper from which we drank the cool, pleasant-tasting water. The building on the street corner was an apothecary's shop, a "drug store" where the apprentice and clerk, Simon Flexner, sold us children candies, gum drops, licorice and sticks of colored peppermint, when we were well, and dispensed to our parents strong medicines—calomel, quinine and preparations of opium—when we were ill. Over that shop a doctor, one of the leading physicians of the town, had his office. His patients, with all manner of infectious diseases, including diphtheria and smallpox, drank from the pump by means of the common dipper on their way to and from his office. He specialized in skin diseases and was particularly well known for his success in the treatment of syphilis; for he had introduced from Europe and administered in his office the then newest treatment—the patient sat under a little tent of cotton cloth with only his head projecting, while a lamp below the chair vaporized mercury about his naked body. Many a syphilitic sore mouth drank from that dipper.

When the physician finished his office hours and went to dinner, he had merely to step across to his home in the house next door, the house with the above-mentioned cesspool. There were no fly screens then on the windows; but there were plenty of stables where this doctor, among others, kept the horses which drew his "buggy," as a doctor's car was called; and each of these stables had an unprotected pile of horse manure in which flies bred freely. Many of these flies, after picking up typhoid and other germs in appropriate places, flew to the dining room table, where this physician, his wife and four children, and his nephews, of whom I was one, enjoyed the bountiful American food of those days, including many good things no longer in market or too expensive now. Our sanitary protection was a coal-black Negro girl who, during dinner, waved a brush of long peacock feathers over the table so as to keep the flies on the wing and out of our milk and butter.

Speaking of that milk, there is one aspect of our present sanitation which, for me at least, has a drawback. Nearly all children then liked "cottage cheese," and I particularly liked the clabber or sour milk before the whey was drained off. To produce clabber, it was only necessary to set fresh milk over night in an open bowl in the kitchen, where it was warm. The milk was already sufficiently infected with lactic acid bacilli so that nature produced such clabber as the pure milk of nowadays yields only when treated with artificially grown organisms. Well might that milk yield clabber! It was brought from the dairy farm in a large can with a spigot sticking out of the back of the milk wagon and a line of pint and quart measures hanging alongside, which the milkman used again and again, unwashed, to measure off the white and foaming stream in the full exposure of a very dusty street. Out at the dairy farm there was no ice; but there was a fine spring house where the milk was set in large flat pans in the running water for the cream to rise. To skim off this cream, the milkman tilted one of those pans over a smaller vessel and then blew his breath vigorously over the surface, so that the upper layer of cream flowed off—a sort of pneumatic skimming.

All of us children had all the common diseases of childhood at an early age and several diseases that are not now common. I had typhoid at the age of six. On summer evenings our parents sat on the front door-steps, chatted with their friends and drank lemonade or mint juleps, of which we children afterward got the sugary leaves, moist with good Bourbon whiskey, to suck. Until we were put to bed under mosquito bars we were busy slapping the anopheles mosquitoes which bred luxuriantly in numerous ponds in vacant lots within the city limits.

Whenever we seemed at all unwell, we received immediately ten grains of quinine with calomel in powder form on the point of a knife. Some of the older people had lost their teeth from being salivated with excessive calomel: this was so common that we children used the word "salivate" as a slang synonym for administering a crushing defeat: thus it would be said of a fight in which Bill thrashed Jack that "Bill hit so hard that he simply salivated Jack." We did a good deal of fighting in those days: the war was recent, and sentiment in Kentucky was pretty evenly divided. Yellow fever did not reach us; but it was feared, for it had one summer come as near as Memphis, Tenn. Smallpox was common, especially among the Negroes, but we were protected by vaccination. For this purpose, on a day in the first year of my life, my uncle, the afore-mentioned doctor, scratched three large areas on my left arm, as evidenced by three large scars which I still bear. To these areas was applied the pus from the arm of another person; and the "takes" were so successful that my first contribution to preventive medicine came from these sores, for a dozen other persons were vaccinated from them. The calf was not the only source of vaccine in those days, although the material from such human cultures sometimes carried other organisms than those of the cowpox. Long afterward Dr. Flexner himself told me that probably at that time no "calf vaccine" was available: but the crust or scab above a healed vaccination pustule, usually wrapped in a piece of white paper, was carried in the vest pocket of the doctor.

Pulmonary tuberculosis was common and the frequency of other forms of tuberculosis was attested by the number of humpbacks that we saw on the street. Of other diseases, diphtheria was most feared and some of my earliest friends died of it. Twice I had deep, penetrating and non-bleeding wounds, once from a thorn in my foot and again from a rusty nail in the oat bin in the stable. I escaped; but one of my friends, who tore his hand on a barbed wire fence when I was ten or twelve years old, died of lockjaw. Nothing was or could be done for him; there was no antitoxin then. Indeed, we who survived must have borne charmed lives, for I carried up to middle life a pair of tonsils bad enough to have been the cause of acute rheumatism or heart disease at any time during forty years. The tops might have been snipped off; but enucleation was then not done. Asthma and hay fever went untreated. For a siege of boils on my feet, my uncle, the doctor who had the office over the "drug store" (a very good doctor too for those days), prescribed a tonic containing iron. A similar outbreak on the same feet many years later was treated with much more rapid success by omitting the tonic and merely disinfecting the shoes with formaldehyde vapor. (Long afterward I published that mode of treatment.)

In spite of all this and much more, we were far better off than our ancestors only a generation or two earlier: when we had a fever, we were not bled, and could drink all the water we wanted. Also surgical operations, although not as yet aseptic, were done under anesthesia—chloroform poured liberally on a towel.

Perhaps the reader suspects that the people who drank from that pump, and whose sanitary ignorance it symbolized, were an unusually backward and ignorant group. To prove that this was not the case, let me describe two families in the neighborhood. The oldest member of one of them, my grandfather, had been the dean of the first medical school west of the Allegheny Mountains and a friend of the great MacDowell. He was also a geologist of distinction, a writer on medical subjects whose works were highly prized and a physician who was so much in advance of his time that he gave as small doses of as few drugs as his patients would permit. One of his sons was the physician over the drug store. Another was a leading surgeon in the southwestern states and had been the chief medical officer of the Confederate Army operating in Tennessee and surgeon on the staff of General Albert Sidney Johnston. In fact, it was a family of distinguished medical men.

The other family had not been so long settled in the country, but they were already respected for intelligence and scholarship. The father had been born at Prague in Bohemia, and had taught school in the university city of Strassburg before emigrating to America. At the time here referred to, he and his wife, who was born on the Rhine, and their nine children were settled in Louisville on the Ohio, and one of the sons was the apprentice in the drug store. Another of the sons, Abraham Flexner, was sometimes about the store out of school hours and also drank from the corner pump.

Sixty and odd years have passed. Starting, as it were, from that pump on the corner and the drugs on the shelves in the shop back of it, Simon Flexner advanced to medicine and began his training in the meager two-year course, lacking in nearly everything that now constitutes medical science, in the medical school at Ninth and Chestnut Streets, where two of the professors were my uncles, the physician and the surgeon mentioned above. The school got its first microscope while Simon was there. Then he went to the Johns Hopkins Medical School as student and later was assistant to Dr. William H. Welch, who had recently brought pathology from Germany. Thus Simon Flexner went forward until he became not only an investigator of the first rank, but also director of the vast service of the Rockefeller Institute for Medical Research.

Meanwhile his brother, Abraham Flexner, who likewise as a child must have imbibed enthusiasm for medical progress with the waters from that pump, went through Johns Hopkins College; then, for a time, into teaching at Harvard; then into the investigation of prevalent methods of teaching and particularly medical education; and so, from one step to another, until he became secretary of the General Education Board and wrote the great "Report on Medical Education in the United States and Canada" (Carnegie Foundation, 1910) which wrought such a revolution in medical teaching and investigation as no previous age had ever seen.

Others of the nine Flexner children, who all sometimes drank from that pump, have had distinguished careers—not indeed in medical science, but all notable for scholarly ability, broad humanity and public spirit.

Evidently those who drank the waters of that pump sixty years ago gained from it or from some other source such inspiration as Greek legend supposed that the poets drew from the spring of Arethusa on Parnassus, the fabled mountain of the Muses. And if men with such inspiration have achieved results verging on the marvelous within one generation their achievements should be an inspiration also for those who are to come after them in what is yet to be done. Truly if, as Oliver Wendell Holmes stated at the time when the cool water was flowing from that pump, the "state of medicine is the best index of the grade of a civilization," civilization in the sixty odd years since then has advanced as never before.

Nothing in this advance is more striking than the decrease in the deaths among children. In the time when Simon Flexner and his brothers passed the perils of birth, infancy and childhood, as in all previous centuries, ten or more children per wife or succession of wives worn out with child-bearing were not an unusual number born in a family; but often few, and sometimes none, survived to be grown. Now it is the knowledge of the diseases of childhood won by the men who drank from that pump and others like it that balances the diminished birthrate and that generally assures to us who now are old the survival and affection of our children and grandchildren.

INITIATIVE IN RESEARCH[1]

By Dr. COLIN GARFIELD FINK

COLUMBIA UNIVERSITY

FORTY years ago industrial research laboratories were practically unknown. To-day no industry can exist without a research laboratory. The phenomenal advances in aviation, electric communication, textiles, corrosion-resistant metals, plastics, vehicles of locomotion, paints and pigments, etc., etc. (to mention but a few of the hundreds of new products and processes introduced during these past forty years) would have been well-nigh impossible without the industrial research laboratories with their facilities and highly trained personnel.

And these research laboratories are not confined to this country, although by far the larger majority of them are now in America. But there are many laboratories in Europe, in Canada, in Russia and elsewhere that are of the very highest type and that have made important contributions to science and industry.

It has often been said that there is a very decided difference between American and European research and that American research was largely of the "development" type, whereas European was predominantly fundamental or radical research. During the early years of industrial research in this country the above statement was largely true. But it is no longer true to-day.

To avoid any misunderstanding, since we are going to enlarge upon "fundamental research," the usual interpretation of fundamental or radical research is that devoted to finding entirely new products or entirely new processes radically different from anything that has gone before. For example, we have John W. Hyatt's work on the production of billiard balls out of a plastic in place of elephants' tusks. This is a case of fundamental research, whereas development research would imply how to raise more elephants or how to alter their feed to develop longer and bigger tusks.

Another example is the research of D. MacFarlan Moore on electric lighting. Abandoning the incandescent lamp he devoted his energies to discovering the secret of the firefly's glow. To-day the fluorescent lamp is the outcome of Moore's researches, granting of course that in recent years a host of researchers have contributed to this fluorescent lamp. But here again this latter-day research was largely of the "development" type.

FUNDAMENTAL RESEARCH

Personally, during my forty years of research experience, I have always been interested primarily in *fundamental* research rather than development research. And my advice to the young student who has inclinations toward research is to choose the fundamental type rather than the development type. We grant that "the work is harder, the standards higher and the discipline more rigorous" than in any other phase of scientific or technical occupation. But on the other hand the interest and excitement, the stimulation and satisfaction are greater by far than in any other field of scientific or technical endeavor.

To give you some idea of what we mean by *initiative in research* we shall give you brief accounts of a few of the many researches that have been carried out under our direction.

THE PLATINUM SUBSTITUTE PROBLEM

When Edison made his first incandescent lamps at Menlo Park he used comparatively thick platinum wires in the seal to carry the current to the filament. Examining some of the old broken lamps we found in the dump at Menlo Park we estimated that at present prices for platinum the cost per lamp approximated $5.00. But in Edison's day platinum was cheaper than gold. The problem of finding a leading-in wire decidedly cheaper than platinum was a very old problem—at least 30 years old—when brought to our attention. At the time I was carrying out researches at the Edison Lamp Works in Harrison, N. J.

---

[1] Lecture delivered at the Stevens Institute of Technology on April 14, 1943.

It was generally agreed that the reason why platinum was being used as an air-tight seal in glass was on account of its coefficient of expansion—almost identical to that of glass, the lead potash glass universally used at the time. Accordingly, it was again generally agreed that any wire that was to be used in place of platinum would have to have the same coefficient of expansion as that of glass. But this idea had persisted for thirty years without bearing fruit: And it occurred to us that there must be something radically wrong with this idea—or possibly that some factor other than coefficient of expansion was at the basis of the solution of the problem. While our own efforts proceeded along fundamental lines, our works manager encouraged "development" research, that is, using shorter pieces of platinum and thinner pieces welded between ends of short copper wires, using platinum ribbon in place of platinum wire, etc., etc. Our platinum budget ran to 7½ million dollars a year and every bit of platinum per lamp saved was appreciable.

We tackled the problem from an entirely different angle. We argued that if a metal or alloy could be found that would adhere tenaciously to glass and would be very soft (like rubber, for example) then, no matter what the coefficient of expansion of the metal might be, this metal would expand and contract as dictated by the more rigid glass.

Accordingly, we selected five commercially available metals and annealed these "dead soft," as we say in metallurgy: nickel, copper, cobalt, iron and silver. To compare results we added platinum.

These six metals were in the shape of thin wires. These wires were sealed into glass and lamps were made up. The lamps were allowed to stand for three days and then were tested for leaks. The performance was surprisingly good, even though many leaky lamps had developed on standing. Examining the seals under the microscope we observed that the *copper and cobalt wires* showed that the wetting quality or the union between glass and metal was exceptionally good —even better in certain respects than between glass and platinum in spite of the fact that the coefficients of expansion for copper and cobalt are much higher than that for platinum—cobalt 138 per cent. of platinum and copper 188 per cent. of platinum; in other words, both cobalt and copper should contract away from the glass on cooling.

To further test our hypothesis we prepared another batch of samples of the six metals: But this time we prepared them in the shape of fine ribbons 3/16 inch wide and again thoroughly annealed.

We next took a glass rod and mounted it horizontally, then heated it at a half a dozen points and sealed the ribbons *onto* (*not into*) the glass. After cooling we attached weights to the other ends of the ribbons. Much to our satisfaction we found that the copper ribbon would support the heaviest weight, next the cobalt ribbon, then the nickel, the silver and the platinum ribbons and finally the iron ribbon which showed the poorest adhesion.

On the basis of these findings we developed a thin-walled copper tube seal[2] which was made to carry either a fraction of an ampere or several hundred amperes. The adhesion of copper to glass was so perfect that lamp tests showed fewer leaks than with platinum. From this first product a second one followed, the so-called dumet wire. In this we again applied the thin tube of copper but filled the copper tube with an alloy of nickel and iron which had a coefficient of expansion lower than glass.[3] This platinum substitute (dumet) is to-day used in all radio tubes, electric lamps and dozens of other types of evacuated glass containers.

THE INSOLUBLE ANODE PROBLEM

When this problem was brought to us the specifications were as follows: The anode must be practically insoluble in a copper sulfate solution containing nitric and hydrochloric acids besides sulfuric. A further specification was that the anode must not contain any element which even though entering the solution in minute quantities might co-deposit with the copper and thereby seriously affect the electrical conductivity.

The solution of this problem was approached from two angles: development research and fundamental research. In the development research we started out by testing anodically well-known acid-resistant alloys such as duriron and nichrome and modified the composition of these to increase their acid resistance. Many hundred alloys were made up, but not one of these was entirely satisfactory.

In the fundamental research approach we considered carefully the reactions that took place at the anode. There were principally two anodic reactions in which we were interested. One was the dissolution of metal—which we wanted to be practically zero—and the other was the evolution of oxygen—which we wanted to be 100 per cent. We concluded that our efforts be bent toward facilitating and promoting the evolution of anodic oxygen. Accordingly, we conceived the idea that if we used a copper plate and covered the surface with an oxygen catalyst the copper would not go into solution. We tried out several catalysts and lo and behold the scheme worked. But there was one hitch in the scheme: It worked only when current was applied: Shutting off the current with the copper plate still immersed would cause the plate to dissolve. Accordingly some provision had to be made for the protection of the copper plate during current interruptions. This part of the problem was solved by adding about 20 per cent. silicon to the copper so that the final anode[4] as introduced at Chuquicamata and in use for many years is a copper silicide alloy with a catalytic surface. The catalysts are manganese dioxide, tin oxide and lead dioxide.

---

[2] Fink and Koerner, U. S. Pat. 1,278,758 (July 23, 1918).

[3] Brit. Pat. 23,775 (October 17, 1912); U. S. Pat. 1,498,908 (June 24, 1924).

ALPLATE

Alplate is the name applied to aluminum-coated steel, aluminum-coated nickel and other metals. The problem of substituting molten aluminum for molten zinc in hot galvanizing was a very old problem when we started our research. Many schemes had been tried, but not one of these developed into a commercial process. One big stumbling block in the past had been the refusal of the aluminum to wet the steel or other metal. You can stick an iron rod into a pot of liquid aluminum and upon withdrawing it the rod will be just as free from aluminum as it was to begin with.

In the development type of research investigators imitated the detailed practice used in hot galvanizing trying out various fluxes, temperatures, speeds, additions to the aluminum, etc. But all these experiments had failed.

In applying the principles of fundamental research it was necessary to carefully study the reason why liquid aluminum would not wet steel. It was not enough, however, to conclude that it was an oxide film on the aluminum that prevented the formation of a good bond between aluminum and steel. The problem now resolved itself into finding a method or means of avoiding the formation of the oxide film or adding some reagent that would counteract the formation of the oxide of aluminum.

One scheme that gave us much encouragement was the introduction of the steel rod or steel strip through a restricted orifice in the pot filled with molten aluminum. But this was not enough: Results were not uniformly good.

The next step solved the problem satisfactorily. It is well known that aluminum oxide is one of the most refractory oxides known and very difficult to reduce to metal. However, there is one reducing agent that will produce the metal and that is atomic hydrogen. It is also well known that iron will dissolve or take up hydrogen and that the amount taken up varies with the temperature. These were the building stones out of which we constructed our final process.

The steel to be coated with aluminum is heated in an atmosphere of hydrogen and allowed to absorb and adsorb as much hydrogen as possible. Then the steel passes into a bath of molten aluminum kept at a temperature *lower* than that of the hydrogen furnace so that the hydrogen is forced out of the steel during the very instant that the steel contacts the aluminum. As a net result a strongly adherent uniform coating of aluminum is produced on the steel.[5]

THE RESTORATION OF BADLY CORRODED BRONZE ART OBJECTS

This problem was brought to us by the Metropolitan Museum of Art. The various methods employed up to that time were very radical. In most cases knives, chisels and hammers were used, in other cases strong acids. But the results achieved were very unsatisfactory and the "restored" product obtained was seldom of any value from an artistic point of view.

Our approach to the problem was based on entirely different principles. We observed in a number of bronzes that the outer contour of the crust of corroded metal was an enlargement of a design which undoubtedly was the original design of the bronze. Further study and experiments on corroded bronze and copper objects led to our discovery that "the detail of design is retained by the crust." Of this we were very certain, and the next step was to find a method of reversing the process of corrosion and bringing back the original design. We decided that an electrochemical, cathodic process was the only practical solution. After some further experimentation the following procedure was standardized and this is now used all over the world: The corroded object is suspended as a cathode in a 2 per cent. solution of sodium hydroxide and a few milliamperes passed through the solution. Very gradually the carbonates and oxides are reduced back to metal. The electric current required is a matter of a few milliamperes per square foot of surface of the bronze or copper object. And the time required is usually a matter of days or weeks, depending upon how far the corrosion of the metal has proceeded. In many cases the objects submitted to us for restoration have no trace of metal left, just a mass of corrosion product.

This research on the restoration of badly corroded bronzes has led to other developments, notably the authentication and attribution of various objects of art and various articles of antiquity not necessarily artistic. The very observations made during restoration are among the most crucial observations in deciding whether a piece of metal, stone, wood or cloth is old or of recent origin.

---

[4] U. S. Patents Nos. 1,441,567 and 1,441,568 (January 9, 1923).

[5] U. S. Pat. No. 2,082,622 (June 1, 1937).

Other Researches

In the few examples above we have tried to indicate the main points of difference between development research and fundamental or radical research. We might go on to tell you how these principles of radical research were applied to:

(1) Our researches on chromium plating and the discovery of the relatively narrow limits of catalytic agent quantities that must be added to the plating bath—*a radically new observation, never before applied to any plating bath.*

(2) Our various researches on tungsten, its crystal structure, crystal growth, its ductility, etc.

(3) Our research on bright nickel plating.

(4) On high chrome-irons.

(5) On electrolytic manganese.

(6) Our researches on corrosion of metals and various means of combating same, etc., etc.

New Problems

The world is full of new chemical and electrochemical problems that await the young investigator. Typical of these many "yet-to-be-solved" problems is the one on *rubber:* Although there are several synthetic rubbers that closely compete with the natural variety, a "complete" substitute is yet to be found. *Might it not be worthwhile to investigate the possibilities of growing rubber trees in the temperate zone?* We have had definite indications in our experiments that the tropical rubber tree, *hevea brasiliensis,* may *be converted into a deciduous tree of the cooler climates by proper treatment and control of the soil constituents.*

Among the numerous other problems that await the young lad with vision and courage are:

(1) *The perfection of electric lighting ten times as efficient as any present type.*

(2) An improved automobile gas engine operating at three or four times the efficiency of the present one.

(3) A paint for wooden structures that is rainproof and sunproof.

(4) An alloy of aluminum as resistant to fatigue as steel.

(5) A metal or other material to take the place of our rapidly dwindling resources of copper—or of lead.

(6) A material to take the place of leather for shoes with all the good, or even better, qualities of leather.

And many, many more problems.

Throughout the ages there have always been young men endowed with the research spirit or research instinct. Very often this is a latent talent that needs to be aroused. And the best procedure in arousing this most valuable talent is to become interested in one or the other phase of science or engineering and then to select one or the other individual topic and apply oneself diligently to this. But reading alone is not sufficient in preparing for research. The laboratory or workshop—no matter how primitive and incomplete—is a most essential adjunct. Reading without experimentation hardly ever leads to the desired results. On the other hand, experimentation with little or no library work frequently leads to radical discoveries.

And in conclusion let me say to the young man: The opportunities in research are greater to-day than ever before. And the chances of finding new products and new processes have never been equalled in the past.

OBITUARY

WILLIAM FRANCIS MAGIE

1858–1943

William Francis Magie was born in Elizabeth, N. J., on December 14, 1858, and died in Princeton on June 6, 1943. He was the son of William Jay Magie, a former chancellor of the State of New Jersey. He graduated from Princeton as valedictorian of the class of 1879, a class that had many other distinguished members, including Woodrow Wilson.

After graduation he remained in Princeton as assistant to Dr. Brackett, then Henry professor of physics. Having decided to make physics his life work it was natural at that time for him to go to Germany to pursue advanced work. He matriculated at the University of Berlin and took his doctor's degree under the direction of Helmholtz in 1885. His dissertation was an experimental study of the theory of capillarity.

Returning to Princeton he was appointed to an instructorship in physics during the presidency of James McCosh, advancing to a professorship in 1890. In 1889 Dr. Brackett founded the graduate school of electrical engineering at Princeton and devoted most of his attention to it. Although Dr. Brackett remained the chairman of the department of physics, Magie became more and more responsible for the actual administration of the department, and its expansion from very small beginnings was very largely the result of his efforts. Dr. Brackett retired in 1909 and Magie was appointed Henry professor in 1910; he retained the chairmanship of the department until his retirement in 1929.

Soon after returning from Germany Magie began the investigations which formed his main contribution to research. These had to do with the properties of solutions, particularly their specific heats and volumes. He not only gathered together the various measurements made by others but made many determinations himself for the purpose of advancing the theory of solutions. His experimental work was done with great skill.

Magie was one of the small group of physicists who met in New York in 1899 to found the American Physical Society. He was a member of the first council of the society and its president during the year 1911–12. He was vice-president for Section B of the American Association for the Advancement of Science and gave his presidential address at the New Orleans meeting in 1905. He was also a member of the American Philosophical Society.

In university affairs in general Magie took a very active part. For many years he served as clerk of the faculty and was an influential member of many of the important committees of the faculty. In 1912 he was appointed dean of the faculty, a position he held until 1925. These administrative duties took so much of his time and attention that in his later years he gradually gave up his activities in research, although he always maintained a keen interest in the work done by his colleagues in the department.

His publications, other than his papers in his field of research, included a revision of the "Text-Book of Physics" by Anthony and Brackett, a text which was widely used in the latter part of the last century. He was a firm believer in the value of the study of physics for the general student, particularly the historical development of the principles. With this in view he wrote his "Principles of Physics" which gives an admirable account of the rise and content of physical theories. He was a master of clear and concise exposition in the best of English. He also translated Christiansen's "Theoretical Physics," and edited the important contributions of Carnot, Clausius and Thomson to the second law of thermodynamics for Harper's series of Scientific Memoirs. When the series of source-books in the sciences was being planned Magie was asked to contribute the volume on physics. This work he began on his retirement in 1929 and he devoted much time and energy to compiling and translating extracts from the memoirs that have had the greatest influence in the development of physics. He was often called upon to speak and write about the life and work of Joseph Henry, a subject of particular interest to him because of Henry's relation to Princeton.

The honorary degree of LL.D. was conferred upon him by the College of Wooster in 1916, and Princeton gave him the honorary degree of D.Sc. upon his retirement.

No account of Dean Magie's life would be at all adequate without an appreciation of his loyalty to his associates and the very real affection that all of us who had the privilege of working with him felt for him.

In 1894 he married Miss Mary Blanchard Hodge, of Princeton, who survives him, as does his sister.

E. P. ADAMS

RECENT DEATHS

DR. HARRY B. MELLER, research engineer of Pittsburgh, Pa., died on June 27 at the age of sixty-five years. Dr. Meller was chief of the air pollution investigation which has been conducted at Mellon Institute since 1923.

DR. W. E. SAUNDERS, ornithologist, of London, Ont., died on June 28 in his eighty-second year.

DR. ABBY LILLIAN MARLATT, from 1913 until her retirement in 1939 director of the department of home economics at the University of Wisconsin, died on June 23 at the age of seventy-four years.

DR. B. RAYMOND HOOBLER, until his retirement as emeritus professor in 1936 professor and head of the department of pediatrics of the College of Medicine of Wayne University, died on June 11 at the age of seventy-one years.

JOHN R. PETERS, petrographer at the U. S. Army Testing Laboratory, Mariemont, Ohio, died on June 24. He was twenty-seven years old.

SCIENTIFIC EVENTS

THE ENRICHMENT OF WHITE FLOUR

THE War Food Administration announces that a public meeting to consider the advisability of requiring all white flour distributed for human consumption to be enriched will be held at 10 A.M. on July 21 in the South Agriculture Building Auditorium, Washington, D. C.

Enrichment of white flour and bread has the endorsement of leading scientific and medical organizations, and of a large part of the milling and baking industries. Under wartime food conditions a further increase in consumption of white flour is expected, and its enrichment would aid in adequate consumption of important vitamins and iron. An inadequate supply of these vitamins leads to nervous instability and other disturbances, with resulting loss of working efficiency. There is a Federal standard for enriched flour, which at present requires specific quantities of thiamin (vitamin B_1), niacin and iron. Beginning on October 1, the vitamin riboflavin also will be required.

The need for a wide distribution of the vitamins and minerals contained in enriched flour was the basis for the provision of Food Distribution Order No. 1 requiring enrichment of all bakery white pan bread. In order that all white bread, whether baked in the home, in an institution or in the commercial bakery, may contain these essential nutritive factors, it has been proposed to enrich all white flour distributed for human consumption.

A proposed order has been drafted in accordance with recommendations received from the National Research Council. The effective date of the order, if issued, will be made not less than 120 days after its date of publication, affording millers who have not enriched their flour an opportunity to obtain necessary equipment and materials. Likewise bakers who are enriching bread by other means will have an opportunity to consume their stocks of enrichment agents.

Persons unable to attend the public meeting may address any communications and expressions of opinion to the Director of Food Distribution, War Food Administration, Washington, D. C., to be received not later than July 26.

The proposed food distribution order reads:

1. *Provisions.* Except as hereinafter indicated, no miller, blender or other person who manufactures or prepares white flour for sale for human consumption may sell or deliver the same unless it conforms to the amended definition of "Enriched Flour" contained in the proposal under the Federal Food, Drug and Cosmetic Act, published in the Federal Register of June 5, 1943, pages 7511–7514. No broker, jobber or other person who handles, repacks or otherwise deals in white flour may sell or deliver the same for human consumption with knowledge that it is not enriched.

(The amended definition describes enriched white flour as containing in each pound not less than 2.0 milligrams of thiamine, 1.2 milligrams of riboflavin, 16 milligrams of niacin or niacine amide and 13 milligrams of iron. Calcium and vitamin D remain optional ingredients as heretofore.)

2. *Exemptions.* The provisions of this order shall not apply to (1) flour delivered prior to the expiration of a period of 120 days after the date of issuance of this order, (2) flour milled and packaged for retail sale prior to the effective date of this order, and (3) flour which may be specifically exempted from time to time by the Director.

3. *Records and reports.* Each person required by the order to enrich flour shall keep and preserve for not less than two years such records as may be necessary to show (1) the volume of his sales of enriched flour, (2) the volume of his sales of flour not enriched, (3) the volume of the different ingredients used by him to enrich flour, and (4) the names of persons from whom such ingredients were obtained.

AWARD OF GUGGENHEIM FELLOWSHIPS

In order to improve the quality of education and the practice of the arts and professions in the United States, to foster research and to provide for the cause of better international understanding, the John Simon Guggenheim Memorial Foundation, established by former United States Senator and Mrs. Simon Guggenheim as a memorial to a son who died on April 26, 1922, offers a limited number of fellowships, tenable under the freest possible conditions, for research in any field of knowledge and for creative work in any of the fine arts, including music. The fellowships are awarded by the trustees upon nominations made by a committee of selection.

The stipend in normal cases does not exceed $2,500 for a year of twelve months. The tenure of fellowships will be adjusted to the purpose and scope of the studies of each individual. Appointments will be made ordinarily for one year; but plans which involve two years' work are considered by the trustees. Fellowships for 1943 have been announced. These include the following in the sciences:

Dr. Edgar Anderson, professor of botany, Washington University, St. Louis; geneticist, Missouri Botanical Garden: A study of the races of *Zea mays* with special reference to Mexico and the Southwest.

Dr. Solomon E. Asch, assistant professor of psychology, Brooklyn College: Continuation of the preparation of a book on the formation and change of opinion and attitude. (Renewal.)

Dr. Emma Lucy Braun, associate professor of plant ecology, Graduate School of Arts and Sciences, University of Cincinnati: Studies of the ecology and taxonomy of the deciduous forest.

Dr. Barbara Stoddard Burks, research associate in psychology, Columbia University: Studies in the field of heredity and environment in human development, in particular to gather materials for a book on the role of twins in the study of man.

Dr. Kenneth Edward Caster, assistant professor of geology, University of Cincinnati: A field study of the stratigraphy, paleontology and paleo-ecology of the Paleozoic strata of the northern sector of the Andes, with particular reference to the age, relationships and fossil faunas of the Andean Devonian sequence as developed in Colombia and adjacent Venezuela.

Dr. Tilly Edinger, research associate in paleontology, Museum of Comparative Zoology, Harvard University: A study of the tooth replacement in Amphibia and Reptilia, particularly primitive fossil types, with special reference to the history of dental succession in the evolutionary line leading from ancestral fishes to mammals.

Dr. Henry Paul Hansen, assistant professor of botany, Oregon State College: A study of Post-Pleistocene forest succession and climate in the Pacific Northwest.

John Francis Hanson, teaching fellow in entomology, Massachusetts State College: A study of the comparative morphology of all accessible genera, species and especially type specimens of Plecoptera (stoneflies) in the United States.

Dr. Floyd Alonzo McClure, professor and curator of economic botany, Lingnan University, Canton, China (on leave): Continuation of the preparation of a revision of the Chinese genera of the Bambusaceae. (Renewal.)

William Vogt, associate director, Division of Science and Education, Office of the Coordinator of Inter-American Affairs: Preparation of a monograph on the ecology of the guano birds of Peru.

The Committee of Selection consisted of Dr. Frank Aydelotte, Dr. Wallace Notestein, Dr. Linus Pauling, Dr. Florence R. Sabin and Dr. Edwin Bidwell Wilson.

Applications for fellowships must be made in writing on or before October 15, by the candidates themselves, in the form prescribed, addressed to Henry Allen Moe, *Secretary General*, John Simon Guggenheim Memorial Foundation, 551 Fifth Avenue, New York, N. Y. Final selection of fellows for 1944–45 will be made in March, 1944. Application forms will be mailed upon request.

AWARDS OF THE SOCIAL SCIENCE RESEARCH COUNCIL

THIRTY-EIGHT awards, amounting to $48,000, for the academic year 1943–44 have been announced by the Social Science Research Council, New York. The awards provide for study and research in the fields of economics, political science, sociology, statistics, political, social and economic history, cultural anthropology, social psychology, geography and related disciplines.

Eight of the awards, carrying a basic stipend of from $1,800 to $2,500 for twelve months, plus travel allowance, cover post-doctoral research training fellowships to men and women under thirty-five years of age who possess the Ph.D. degree or its equivalent. These fellowships are granted for the purpose of amplifying and sharpening the research training and equipment of promising young investigators through advanced study and field experience.

Seven appointments are pre-doctoral field fellowships which carry a basic stipend of $1,800 for twelve months plus travel allowance. The recipients are graduate students under thirty years of age who have completed all the requirements for the doctorate except the dissertation. The purpose of these awards is to offer the opportunity for first-hand contact and experience with the phenomena of social science in the raw, as a supplement to formal graduate study.

The remaining twenty-three awards are grants-in-aid designed to assist mature scholars in the completion of research projects already well under way. These grants average about $580 this year, but individual grants in any year do not ordinarily exceed $1,000. Five of the appointments were made through a special fund granted solely for the purpose of assisting and encouraging the research of social scientists in the South. The objectives and requirements for eligibility are the same as those governing the national grants-in-aid, but applications are restricted to thirteen southern states.

FOREIGN MEMBERS OF THE ROYAL SOCIETY, LONDON

Nature gives the following particulars in regard to the work of Professors Goldschmidt and Houssay, whose election to foreign membership in the Royal Society, London, was recently announced in SCIENCE.

Professor V. M. Goldschmidt has made outstanding contributions in each of the fields of petrology, crystal chemistry and geochemistry. His early studies in rock metamorphism marked a major advance in the correlation of the chemical and mineralogical composition of thermally reconstituted rocks and contained the first successful essay towards a systematic classification of rock-mineral assemblages in the light of the phase rule. The leader of great schools of geochemistry both at Göttingen and Oslo, Goldschmidt has for many years devoted his attention to the discovery of the principles governing the terrestrial distribution of the elements: in this program his classical researches on the crystal structure of ionic compounds were early achievements and may be regarded as laying the foundation of the science of crystal chemistry. His exhaustive series of investigations on the chemical composition of rocks and minerals has revolutionized our knowledge of the distribution of the minor constituents of the earth's crust, while his similar studies on meteorites have brought a special contribution to the problem of the chemistry of the earth's deep interior. It is in these comprehensive researches, both geochemical and crystallochemical, that Goldschmidt has contributed in such large measure to the present-day picture of the geochemical evolution of matter within the lithosphere.

Professor Bernardo Alberto Houssay, of Buenos Aires, is one of the outstanding men of science of Latin America. He has held the chair of physiology in the University of Buenos Aires since 1919, and has made his laboratory a leading center for endocrine research. His most remarkable discoveries concern the effect of the anterior pituitary body on carbohydrate metabolism; he showed that although the removal of the pancreas alone will cause diabetes, yet if the anterior lobe of the pituitary is removed at the same time the animal has no glycosuria and stays in reasonable health. Further analysis made it clear that the anterior lobe of the pituitary secretes a hormone with an opposite effect on sugar metabolism to that of insulin, and that it is the absence of this hormone in the "Houssay animal" which accounts for the lack of glycosuria when the pancreas is removed. Many other chapters in the complex story of endocrine interactions have been worked out in Professor Houssay's laboratory and he has recently dealt with the problem of renal hypertension and the nature of the toxic substance which may be liberated by a diseased kidney. He is an honorary member of the Physiological Society and has published various papers in the *Journal of Physiology*.

MEDICAL FELLOWSHIPS OF THE NATIONAL RESEARCH COUNCIL

At the February meeting of the Medical Fellowship Board of the National Research Council, Washington, D. C., of which Dr. Francis G. Blake, Sterling professor of medicine at Yale University, is the chairman, one fellowship in the medical sciences, a renewal, was awarded. Seven appointments, including two renewals, were made to fellowships in the filterable viruses and orthopedic surgery. A list of the successful candidates and the institutions where they are to work follows:

Medical Sciences

Lester J. Talbot (renewal), New York University College of Medicine.

Filterable Viruses

Edward H. Anderson, Vanderbilt University.

H. Chandler Elliott (renewal), University of Toronto.

I. William McLean, Jr., Duke University School of Medicine.

Alison H. Price, University of Michigan (declined appointment).

Hugh Tatlock, Yale University School of Medicine and the Acute Respiratory Diseases Commission Laboratory, Fort Bragg, N. C.

Herbert A. Wenner, Yale University School of Medicine and the Johns Hopkins University.

Orthopedic Surgery

Maxwell F. Kepl (renewal), Tulane University of Louisiana.

Welch fellowships in internal medicine were awarded to the following at the meeting of the Medical Fellowship Board in April:

S. Howard Armstrong, Jr., Harvard Medical School and the Peter Bent Brigham Hospital.

Joseph F. Ross, Evans Memorial Hospital, Boston, Massachusetts.

SCIENTIFIC NOTES AND NEWS

The Benjamin Carver Lamme medal, awarded annually by the American Institute of Electrical Engineers for meritorious achievement in the development of electrical apparatus or machinery, was presented at the Cleveland meeting to Dr. Joseph Slepian, associate director of the Westinghouse Research Laboratories. The medal was awarded in recognition of his work on "the development of current-interrupting and current-rectifying apparatus. He developed the ignitron, an electronic tube now being used in aluminum and magnesium plants to convert alternating electric current required for the production of these metals."

Michael Lerner, for his services to Chile in connection with his expedition in 1940 under the auspices of the American Museum of Natural History, has been awarded the decoration "Al Mérito" in the degree of "Comendador" by the Government of Chile.

Dr. J. C. Geiger, director of public health of San Francisco, recently received the award of fellow and "member correspondiente" of the National Academy of History of Panama.

We learn from the *Journal* of the American Medical Association that on July 2, the eightieth birthday of Dr. Ludvig Hektoen, the Hektoen Institute for Medical Research of Cook County, Illinois, was dedicated in his honor. Dr. Morris Fishbein, editor of the *Journal*, presided at the ceremonies. The building, formerly the McCormick Institute for Infectious Diseases, has been purchased by the board of Cook County commissioners. A portion of the building is already in use. A plaque bearing a bas-relief of Dr. Hektoen was unveiled in the entrance of the institute. The presentation was made by Clayton F. Smith, president of the board of commissioners, and Dr. Karl Meyer received it on behalf of the institute.

At a meeting on April 15 of the History of Medicine Society of Tulane University, as reported in the *Journal* of the American Medical Association, the Rudolph Matas award for the best paper on the history of medicine presented before the society was given to Charles M. Wilson, senior in the medical school, for his paper on "American Contributions to Neurosurgery." The I. I. Lemann Award for the best discussion before the society was presented to Dr. Leonard K. Knapp, junior in the medical school, for his discussion on aviation medicine. The presentations were made by Dr. B. Bernard Weinstein, instructor in gynecology in the medical school at New

Orleans. Harold Cummins, professor of microscopic anatomy, was the principal speaker, discussing "Extra Medical Interests of Charles Richet, Arthur Conan Doyle and Dr. Krandon."

The University of California at Los Angeles at its commencement exercises on June 9 conferred the degree of doctor of laws on Dr. H. S. Jennings, research associate of the department of zoölogy, and Dr. H. J. Webber, emeritus professor of subtropical horticulture of the Citrus Experiment Station at Riverside of the University of California.

Dr. F. W. Hodge, director of the Southwest Museum, Los Angeles, received the honorary degree of doctor of literature from the University of Southern California on May 23.

The doctorate of science was conferred by the University of Oregon on May 30 at its sixty-sixth annual commencement on Dr. Ralph Albert Fenton, clinical professor of otolaryngology at the medical school of the university, and on Dr. Rosalind Wulzen, assistant professor of zoology at the State College. Citations by President Donald M. Erb read: "Ralph Albert Fenton: In recognition of his notable researches in the field of otolaryngology; his vital contributions to medical science; and his tireless efforts in advancing the standards of medical practice in the Commonwealth of Oregon. Rosalind Wulzen: In recognition of her outstanding contributions in the field of experimental biology; her nationally recognized researches on the subject of nutrition; and her discoveries related to calcium metabolism which have far-reaching clinical possibilities."

The following officers of the University of Oregon Chapter of Sigma Xi for the year 1943–44 were elected at a meeting of the chapter on April 26: *President,* Dr. Pierre Van Rysselberghe, associate professor of chemistry; *Secretary,* Dr. John M. McGee, acting associate professor of chemistry, and *Treasurer,* Dr. Arnold L. Soderwall, instructor in biology. New members and associates were initiated at a meeting on May 15. The joint annual Sigma Xi-Phi Beta Kappa lecture was delivered by Dr. Arthur R. Moore, research professor of general physiology. He spoke on "The Two Great Books of 1543: Copernicus' 'De Revolutionibus Orbium Coelestium' and Vesalius' 'De Humani Corporis Fabrica.'"

According to *The New York Times,* Dr. Frederic Joliot conjointly with Mme. Irene Joliot have been elected members of the French Academy of Sciences. Mme. Joliot is a daughter of Dr. Marie Curie.

At Western Reserve University, Dr. J. Paul Quigley has been appointed professor of gastro-intestinal physiology and Dr. Edward Muntwyler has been appointed professor of experimental biochemistry.

Dr. Lewis M. Turner, senior forester, Branch of Research, U. S. Forest Service, Washington, D. C., has been appointed dean of the School of Forestry and Range Management of the Utah State Agricultural College.

Dr. Elmer H. Stotz, director of the chemical laboratory at McLean Hospital, Waverly, Mass., and a member of the teaching staff in biochemistry of the Harvard Medical School, has been appointed by the Board of Trustees of Cornell University professor of agricultural and bio- chemistry and head of the Division of Chemistry at the New York State Experiment Station at Geneva. The appointment becomes effective on August 1. Dr. Stotz succeeds Dr. Donald K. Tressler, who resigned early in the year to enter the industrial field.

Dr. Henry D. Bergman, professor of veterinary physiology and pharmacology, has been named dean of the Division of Veterinary Medicine at Iowa State College, to succeed Dean Charles Murray. Dr. Murray will continue to serve both as head of the department of veterinary hygiene and as assistant director of the Veterinary Research Institute.

G. D. Preston has been appointed to the Harris chair of physics at University College, Dundee. Mr. Preston is known for his application of physical methods to metallurgical problems.

Roscoe Roy Spencer, medical director of the U. S. Public Health Service and assistant chief of the National Cancer Institute, Bethesda, Md., will become chief of the institute, the appointment to be effective on August 31. He will succeed Dr. Carl Voegtlin, who is retiring as director.

The Board of Scientific Directors of the Rockefeller Institute for Medical Research announces the following promotions on the scientific staff, effective on July 1. *Assistant to Associate,* Dr. Merrill W. Chase, Dr. Stanford Moore, Dr. Isabel M. Morgan, Dr. Howard A. Schneider and Dr. William H. Stein. *Fellowship to Associate,* Dr. D. Wayne Woolley. *Fellow to Assistant,* Dr. Sidney Rothbard. The board also announces that Dr. Oswald T. Avery, who has reached the age of retirement, has been made member emeritus.

Dr. Conrad Berens, of New York City, has been appointed civilian consultant in ophthalmology to the Office of the Air Surgeon.

Elmer S. Riggs has been appointed honorary curator of paleontology at the Dyche Museum of the University of Kansas. This appointment takes effect as of June 2.

Chris L. Christensen, dean of the College of Agriculture of the University of Wisconsin, has become vice-president in charge of post-war development of the Celotex Corporation. He will also have charge of agricultural interests. Dean Christensen has been a director of the corporation since March, 1942.

T. W. HOWARD has been appointed superintendent of turbine and marine installations at the General Electric Company; E. L. Feininger has been appointed manager of the new division for resin and insulation material, and Dr. J. J. Pyle, group leader in charge of research and chemical development at the plastics laboratory at Pittsfield, Mass., has been appointed chemist in charge of the laboratory, succeeding Dr. G. F. D'Alelio, who has resigned.

EMMETT P. DUNN, curator of reptiles at the Academy of Natural Sciences of Philadelphia, left by airplane for South America on June 20. Serving under the auspices of the Committee for Inter-American Artistic and Intellectual Relations, he has been assigned to the Institute of Natural Sciences of the National University at Bogota, Colombia, to work on the collections of the reptiles and amphibians of the eastern slope of the Andes and to collect in the field.

A PARTY from the staff of Field Museum of Natural History began diving operations in Lake LaGrange at Dowagiac, Mich., on June 23 in order to complete studies necessary for the creation of an underwater habitat group of typical fresh-water fishes at the museum. Members of the party are Loren P. Woods, acting curator of fishes; Arthur G. Rueckert, staff artist; Leon L. Pray, taxidermist, and Frank H. Letl, preparator of accessories. The underwater studies are directed toward assuring a faithful reproduction in the museum exhibit of the submerged vegetation typical of the small lakes frequented by anglers in Michigan, Indiana, Illinois and Wisconsin. The fishes to be shown in the group include black bass, pickerel, yellow perch, wall-eyed pike, sunfishes, crappies, bullheads and minnows.

A CABLE dated June 24 from Guatemala to *The New York Times* states that a commission of sanitation experts, which is studying conditions along the route of the inter-American highway, had arrived at Guatemala. Dr. John R. Murdock, chief of the mission, is accompanied by Sanitary Engineers Charles C. Spenser, Herbert E. Hargis and Walter Dashiel. A careful study, which it is expected will be completed this year, is being made of drinking-water supplies, drainage and tropical diseases existing near the highway.

THE two hundred and fifty-sixth meeting of the American Physical Society will meet at Stanford University, California, on July 10. Following four contributed papers to be read at the morning session, invited papers will be given by L. Marton and Hardin Jones. The afternoon session will open with an invited paper by K. K. Darrow. Subsequent meetings are scheduled as follows: Chicago, November, 1943; Pacific Coast meeting, December, 1943, and the annual meeting, New York City, January, 1944.

A BILL to provide increased educational opportunities in Alabama has been signed by Governor Chauncey Sparks. $100,000 is appropriated annually for the Tuskegee Institute, of which Dr. F. D. Patterson is president. The bill provides that the fund be used for teaching graduate work in agriculture and home economics, and such other subjects as the board of trustees deems advisable.

ALBION COLLEGE has received the Charles W. Fallass herbarium as a gift to the college of the Fallass estate of Petoskey, Mich. Mr. Fallass graduated from the college in 1873. The herbarium contains approximately ten thousand specimens of both flowering plants and ferns mostly from Michigan, though many specimens have been secured by exchange from other parts of the United States, Canada, Mexico and countries abroad.

DR. ALEXANDER S. WIENER, head of the blood transfusion division at the Jewish Hospital of Brooklyn, has been awarded a grant of $3,000 by the United Hospital Fund, to carry on investigations on the prophylaxis and treatment of erythroblastosis fetalis.

THE U. S. Board of Education, under the E. S. M. W. T. program, has approved a series of courses in Sanitation Problems in Food Handling and Processing, sponsored by Manhattan (Engineering) College and the New York City Department of Health. Dr. J. H. Shrader has been retained to organize this course and direct the work of the instructors. The classes are organized into sections which deal with subjects of related content, such as baking, milk, meat, and others. Each class enrolls about twenty-five students and there are now eleven such classes, with a total of about three hundred students. The emphasis is chiefly on the technology of food production with a background of proper sanitary practice and understanding of the health problems involved. Open to high-school students without charge and conducted at college level, the course runs for six weeks of two sessions per week of three hours each. A certificate is issued by the New York City Health Department for those who successfully pass the course as determined by class work and final examination. A repeat series is scheduled to start about the middle of September. Those interested should write to A. D. Donovan, Manhattan College, Bronx, New York.

IT is reported in *The Lancet* that several medical schools expect to return soon to London provided that essential repairs to their buildings can be undertaken. The medical students of King's College have already returned from Birmingham and the preclinical students of the Middlesex Hospital from Leeds, the London School of Medicine for Women is bringing back its preclinical students from Exeter and the London Hospital its preclinical students from Cambridge. The whole medical school of University College Hospital is also returning to London as the sector hospital which has been used for teaching is no longer available. Among the schools whose buildings have suffered extensive damage are University College and St. Bartholomew's Hospital Medical College, and these schools are considering schemes for temporary accommodation after the war so that their return to London need not wait upon the completion of the permanent buildings.

The Times, London, states that the Government of New South Wales is setting up a cancer institute at Sydney, the cost of which will be £100,000. Dr. Ralston Paterson, of the Holt Radium Institute, Manchester, England, is going to Australia to advise on the project.

THE British Institute of Chemistry hereafter will be known as "The Royal Institute of Chemistry of Great Britain and Ireland."

DISCUSSION

IMPLICATIONS INVOLVED IN MATHEMATICAL ADVANCES

HISTORIES of mathematics have seldom emphasized duly the fact that mathematical advances usually imply corresponding mathematical ignorance of the entire world up to the time when these advances were made. It is largely due to this fact that many educated people regard mathematics as a much older subject than it actually is. The numerous modern mathematical advances are greeted with applause, but their effectiveness would often be enhanced by exhibiting clearly to what extent they dispel ignorance relating to the same subjects. This is especially true as regards the history of mathematics since American contributions towards the advancement of this subject have thus far been unduly limited. Our writings thereon have been too largely confined to text-books which were usually not up-to-date even at the time of publication.

Advances in pure mathematics have always been within the reach of the poor and the rich alike since they required no expensive equipment. In this respect they differ widely from the achievements in warfare since the latter have always depended largely on the improvements in physical equipments, which, in turn, often encouraged the diffusion of mathematical knowledge. The free accessibility as regards advances in this subject constitutes an important element of its history because it tended to widen the variation of those working in this field. Those who contributed to the advancement of mathematics often worked in obscurity and with meager facilities.

For instance, J. V. Poncelet, who is commonly regarded as the creator of projective geometry, remarked in the first pages of his noted "Traité des propriétés projectives des figures" that this work was the result of researches which he undertook in the spring of 1813 in the prisons of Russia, where he obviously did not have much physical equipment for scholarly work. E. Galois, who greatly stimulated the early development of group theory, died before he was twenty-one years old when his work had as yet received little attention. He is the most conspicuous example of a mathematician whose present reputation depends almost entirely on the work of later writers who developed results which follow from ideas which he had announced but did not have time to master completely. His great modern reputation is evidence of a widespread desire on the part of the earlier mathematicians to give credit for the ideas which inspired their own work. It would be too idealistic to assume that this desire was universal or is universal now.

The history of mathematics is greatly enriched by the consideration of each decided advance in the light which it throws on the mathematical developments of all earlier times. For instance, the fact that H. Cardan published in his "Ars Magna" (1545) the earliest known solution of a quadratic equation having two complex roots sheds much light on all the earlier work relating to the quadratic equation, including that of the ancient Babylonians (about 2000 B.C.) and that of the ancient Greeks which was done more than fifteen hundred years later. The fact that the Norwegian surveyor, Caspar Wessel, published in 1799 the earliest satisfactory theory for operating with complex numbers by means of the fundamental operations of arithmetic throws much light on the extensive earlier use of these numbers during about two hundred and fifty years after the publication of Cardan's "Ars Magna."

This use of complex numbers before its legality had been established was not confined to mathematicians who received little recognition on the part of later writers on mathematics. It included Isaac Newton (1642–1727), who considered the number of the imaginary roots of an algebraic equation; G. W. Leibniz (1646–1716), who factored $x^4 + a^4$ into its linear factors and used them in the decomposition of fractions into partial fractions; John Bernoulli (1667–1748) who exhibited the connection between the arc tangent and the logarithm of an imaginary argument, and Leonhard Euler (1707–1783), who introduced in 1740 the use of imaginary exponents. The large number of interesting results which had been obtained by the use of complex numbers before the legality of this use had been proved may partly account for the fact that this proof failed to attract much attention until many years after it was first published. Correct results have frequently inspired faith in the correctness of the methods employed and were often accepted as proof of this correctness.

Although negative numbers were used much earlier than complex numbers, the solution of a quadratic equation having two complex roots seems to have preceded by about eighty-four years the solution of such an equation having two negative roots. The earliest known example of the latter appears in the "Invention nouvelle" by A. Girard which was published in Amsterdam, 1629. The late appearance of such a solution directs attention to the fact that the general use of negative numbers came much later than might be inferred from the modern early use of them in our schools. Among the late strong opponents to the use of these numbers was Robert Simson (1687–1768), who was professor of mathematics in the University of Glasgow for forty years after 1711.

Hence it results that what the modern high-school student is supposed to master easily gave much trouble to a noted professor of mathematics less than two hundred years ago. Possibly the concealing of difficulties in elementary mathematics is too frequently regarded as a simplification of the subject. While a clear explanation of the theory of operating with negative numbers does not seem to be older than the corresponding theory relating to complex numbers it is a clear exaggeration to assert that "the one glimmer of mathematical intelligence in the early history of negatives is the suggestion of Fibonacci that a negative sum of money may be regarded as a loss." This assertion appears in the "Development of Mathematics" by E. T. Bell (page 158, 1940). On the contrary, the ancient Babylonians already used the terms "tab" and "lal" with respect to numbers as we now use + and − to represent distances in opposite directions from a fixed line.[1]

G. A. MILLER

UNIVERSITY OF ILLINOIS

AN UNRECORDED CAUSE OF "RED WATER"

RED WATER has attracted the attention of seafarers since early times. Various marine organisms have been cited as giving rise to this phenomenon, frequently ascribed to one or another species of dinoflagellate, as, for instance, *Gonyaulax polyhedra* off our own west coast, but never before do trochophore larvae seem to have produced it.

In 1935 I had the good fortune of accompanying Captain Allan Hancock, of Los Angeles and Santa Maria, California, on another of his memorable Pacific Expeditions aboard his motor cruiser, the *Velero III,* now in the service of the U. S. Navy. The third of January saw us headed southward off the coast of central Peru, angling across the Humboldt or Peruvian current. During that afternoon, while a little more than 50 miles to the westward of the Lobos de Tierra Islands (6° 28′ S., 81° 51′ 30″ W.), many patches of "red water" were seen all afternoon. A sample dipped up in a bucket from one of them was preserved in formalin for later study.

The contained organisms, thought at the time of collection to be peridinians, though very much plasmolized as the result of preservation, were unmistakably some species of trochophore larva, either mollusk or annelid. Dr. Martin Johnson, of the Scripps Institution, in commenting on the material says, "There is a possibility that the larvae could be those of a bivalve mollusk—the trochophore stage of gastropods usually occurs while yet enclosed in a case. I was, however, unable to make out any shell gland, a feature characteristic of bivalves in this stage. The trochal cilia also seemed to be more characteristic of annelids." He adds that it was perhaps not possible to settle the question from the specimens at hand. It is to be regretted that these larvae were not sufficiently far advanced in development to permit definite determination.

As trochophores apparently have not heretofore been observed as causing "red water," the fact that they were present in such enormous numbers as to give rise to this phenomenon seems worthy of note. No temperature reading was made at the time of the taking of the sample, but while on the same course the surface temperature at 10:05 A.M. registered 19.50° C. (6° S., 81° 41′ W.) and at 5:30 P.M., 20.32° C. (7° 50′ S., 81° 53′ 30″ W.).

Besides Dr. Johnson, I am also indebted to Dr. Herbert Graham, Mills College, and Dr. Olga Hartman, Allan Hancock Foundation, University of Southern California, for critically examining the sample; and to Captain Allan Hancock for permission to publish these notes upon it.

WALDO L. SCHMITT

U. S. NATIONAL MUSEUM

THE TEACHING OF TROPICAL MEDICINE

THE request of the armed forces that medical schools give more emphasis to tropical disease presents new problems in methods of instruction. Most schools of medicine in the United States are located in regions where there are few if any examples of the important parasitic diseases, and hence clerkship or ward teaching is not possible. An alternative is a series of lectures or "dry clinics," supplemented by lantern slides and charts. This latter method is obviously deficient, since a thorough knowledge of a disease is rarely acquired without the study of patients. When a hospital patient is not available for study, the best substitute is the presentation of a case at a clinicopathological conference. In this exercise, if the case is treated as an unknown, it is possible to discuss the differential diagnosis and treatment in much the same way as in ward teaching. There is the added advantage that the pathologic changes can be presented at the conclusion of the clinical discussion.

---

[1] *Cf.* O. Neugebauer, "Vorgriechische Mathematik," page 18, 1940.

At the Washington University School of Medicine an attempt has been made to develop the clinicopathological method of teaching tropical medicine. Representative gross specimens of specific cases, together with a full abstract of the clinical record, have been borrowed from other laboratories. The abstract is mimeographed and given to the staff and students two days in advance of the conference to allow ample time for study. At the conference the clinical record is briefly reviewed, and a senior clinician then discusses the differential diagnosis and treatment. Specific points are brought out by questions directed to members of the attending staff, each of whom has previously read the abstract and formulated an opinion. Finally the gross and microscopic observations and a summary are presented by the pathologist.

Since January 1, cases of leprosy, amebic dysentery, yellow fever and schistosomiasis have been presented in clinicopathological conferences to members of the third and fourth year classes of the medical school. The reaction of both the staff and the students has been sufficiently favorable to suggest that clinicopathological conferences may serve as a valuable method of teaching tropical medicine in medical schools of the United States.

HARRY L. ALEXANDER
ROBERT A. MOORE
W. BARRY WOOD, JR.
WASHINGTON UNIVERSITY SCHOOL OF MEDICINE,
ST. LOUIS

THE ELGIN BOTANIC GARDEN

THE question "Who Established the Elgin Botanic Garden?" which Dr. C. Stuart Gager puts as a title for his able article in SCIENCE, November 13, 1942, has arisen largely because certain reviewers of "Dr. Bard of Hyde Park" have implied that more credit should be given to Samuel Bard than to David Hosack.

It is fairly stated in my biography of Dr. Bard that his medical partner, Dr. Hosack, who was 27 years his junior, conceived the idea of the Elgin Garden in 1795 (p. 188). It was some six years later that Dr. Hosack purchased land for this botanic garden in what is now the midtown section of Manhattan, but in another six years he found the financial burden of maintaining the garden was too much for him to continue, and therefore in 1807 he offered the land for sale (p. 233).

At this point Samuel Bard came forward publicly and privately with the plea that the State Legislature should purchase the garden from Hosack and so established it for posterity (pp. 243, 244). Even after this was accomplished in 1810 the maintenance of the garden was still a dilemma. The College of Physicians and Surgeons with Bard as president and Hosack as professor undertook to carry on the garden until in 1816 the land where now rises the Rockefeller Centre was ceded to Columbia College. Thus in spite of Hosack's creation and Bard's sponsoring this ambitious adventure came to an end in 1819 so that the answer to the question seems to be that no one succeeded in establishing the Elgin Garden.

Another experimental garden which had its first inception in plans laid out by Samuel Bard in 1746 (pp. 80, 81, 83) for his great-grandfather's estate on the Hudson River called Hyde Park, still continues, however, as a monument of the botanical effort of Bard and Hosack. This estate was purchased by David Hosack after the venerable Dr. Bard's death and has received expert care from subsequent owners to the present day. It is now part of the National Parks Service and is known to many as the setting for the Vanderbilt Mansion National Historic Site at Hyde Park. After the war it is planned to make this eighteenth century garden a center for those interested in the science of botany.

J. BRETT LANGSTAFF,
President of The National Historic Site Association of Hyde Park

SCIENTIFIC BOOKS

NICHOLAS COPERNICUS

Nicholas Copernicus, 1543–1943. By STEPHEN P. MIZWA. The Kosciuszko Foundation. 88 pp. 20 illus. 1 map. 1943. $2.00.

REGARDLESS of these tragic and turbulent times, the spirit of humanism and culture endures. This philosophy of life may not always be able to express itself, yet we have had many evidences these past centuries that civilization does survive where culture and learning prevail. One form of this evidence is truly expressed by the Polish organization, "The Kosciuszko Foundation of New York."

The richness and fullness of life seems to increase with every advancement in the philosophy of pure science, art and literature. It is to those who have caused these advances that we in succeeding generations wish to pay tribute and to commemorate their works. These two years—1942 and 1943—are indeed epoch-making in recording the anniversaries of some of these great prophets. To name a few, we have Galileo (1564–1642) in physics; Newton (1643–1727) in mathematics and astronomy; Halley (1656–1742) in astronomy and meteorology; Lavoisier (1743–1794) in chemistry; Koch (1843–1910) in medicine, and Copernicus (1473–1543) in astronomy. There are various forms of commemoration, but usually these take place on some given date, such as birth or death. With Copernicus, however, we have the unusual experience of commemorating the first appearance of his great work, "De Revolutionibus Orbium Coelestium," 1543, which announced to the world, at his death-bed, the true order of the solar system, and from thence we found ourselves completely reorientated in the universe. Philosophically speaking, this influenced our minds to the extent that an intellectual revolution took place.

This beautiful brochure, prepared by Dr. Mizwa, is small in physical appearance, but incredibly rich in learning and humanistic philosophy. The material contained therein brings vividly to mind the life and work of the founder of modern science and observational astronomy. The greatness of Copernicus does not rest alone upon his clear formulation, through laboriously long series of observations of the movements of the planets in respect to the sun, but in reality he laid the foundation for the whole realm of modern celestial mechanics. Kepler, Newton, LaPlace, Gauss, Newcomb and a host of others followed in his footsteps.

Copernicus came from an old Silesian family, born in 1473, in Torun, Poland, during the period this section was Germanic. At the outset, one is thoroughly awakened to the large amount of historical and bibliographical work necessarily involved in bringing to us this new picture of Copernicus's life. His manifold interests and activities, as given here, reveal what a full life, both secular and spiritual, he lived. The contents of this book is divided into four parts. Part I and Part II contain the salient features of his life, as well as the early concepts of our solar system. The doctrine of the Ptolemaic geocentric system, which prevailed for over 1,500 years, was finally supplanted by Copernicus's heliocentric system. This is followed by an account of Copernicus, the economist, which is indeed a new phase of the astronomer's life, not generally known. The principal activities during this period were in the formulation of the law of bad money with scientific precision, not evident in any of his predecessors. Newton faced the same problem for the British Crown in 1695–96. The third phase of this part treats upon Copernicus as a churchman, statesman and soldier, it being virtually a biographical sketch. This is followed by a section giving a brief account of the slow recognition of the new truth concerning the cosmic order.

In view of the scholarly research work manifested in this small book, we are here given, once and for all, the assurance that Copernicus was born a Pole, and not a German. Irrespective of political ties, blood ancestry has proven this to be true. He was the most inveterate enemy of the so-called "Knights of the Teutonic Order," then headed by Albert Hohenzollern, 1490–1568.

Part II, the Sarmaticus Astronomus (Sarmatia being the ancient name for Poland) consists of miscellaneous phases of the life of Copernicus, and the origin and meaning of the name, as well as some aspects of the territorial complex of Prussian Poland and the Corridor. Why the Poles are proud of Copernicus is because the whole civilized world claims him as its own.

Special attention should be called to the footnote references and bibliographical suggestions and comments. This to the reviewer's mind always makes a complete treatise. The last two parts relate to program suggestions, bearing particularly upon the quadricentennial celebration, and upon the educational reconstruction of Poland in the name of Copernicus.

Very few books are so well balanced in their selection of historical illustrations, such as portraits, statues, title-page facsimiles, etc., together with a rare print of his birthplace and the death scene of Copernicus. This last shows him dimly able to behold the first copy of his great work.

The art of the old world seems to have been transplanted to the American continent in the frontispiece. Seldom does one find such exquisite medieval art as is revealed in this beautiful example. The intricacies of the design and the brilliantly contrasting colors are here so vividly reproduced. The symbolism represents Copernicus as a churchman and a scholar—more specifically as an astronomer. The chain and cap are academic symbols. In the left hand he holds a device which illustrates one of his astronomical principles of planetary motion. In the upper right-hand corner is the coat-of-arms of the University of Kraków. But one must see it in order to fully appreciate the numerous details. This design was contributed by a refugee Polish artist, Arthur Szyk, perhaps the greatest living miniaturist working in the technique of illuminated medieval manuscripts.

It is interesting to note that "De Revolutionibus Orbium Coelestium" is the rarest book in scientific literature to-day. The Union Catalogue of the Library of Congress records ten known copies of the first edition, Nürnberg, 1543, eleven known copies of the second edition, Basle, 1566, and six copies of the third edition, Amsterdam, 1617, in the United States and Canada.

Frederick E. Brasch

The Library of Congress

THE ELECTRON MICROSCOPE

The Electron Microscope. By E. F. Burton and W. H. Kohl. 233 pages. New York: Reinhold Publishing Corporation. 1942. $3.85.

This book attempts the ambitious problem of taking a reader with infinitesimal knowledge of physics through the steps necessary to understand the electron microscope. There are, therefore, of necessity many inequalities of difficulty. However, the authors have succeeded as well as might be expected in this difficult task.

The first six chapters take the reader through some of the most elementary rudiments of optics, and the cartoon method of illustration is used freely with the objects and images depicted by cats, giraffes, etc., and where wave motion is explained by the picture of a child upsetting a pile of books. It is not to be expected that the reader who needs these devices will get a very clear comprehension of the "dual theory of light and of the electron" as propounded in Chapters 8 and 9; and the attempt to explain the motions of electrons in electromagnetic fields will probably be comprehensible to an appreciable degree only to those for whom the elementary parts are unnecessary. In this connection, the present reviewer feels that the statement on page 111 may lead the elementary student to believe that electrons starting with zero velocity continue to follow the lines of force. This they would strictly do only when moving with short mean free path as ions in a gas.

In spite of the foregoing unavoidable difficulties of presentation, the latter part of the book gives a very readable account of the potentialities of the electron microscope and of the essentials involved in its operation. The section dealing with the power of the microscope to reveal emission characteristics of thermionic emitters of various kinds will be of interest to many research physicists.

The book gives a clear picture of the orders of magnitude in relation to the various possibilities realizable with the electron microscope; and it will probably be of the greatest use to those who have no previous acquaintance with the microscope but are, nevertheless, beyond the stage for which the more elementary explanations would be necessary.

The implication on page 108 that a vessel containing millions of molecules represents a poor vacuum is probably a pure oversight, for, of course, a vacuum of 10^{-8} mm still contains about 3×10^{8} molecules per cc.

RADIOACTIVITY

Kuenstliche Radioaktivitaet. By Kurt Diebner and Eberhard Grassman. xi + 87. Leipzig: S. Hirzel. 1939.

This book seems to be a valuable compilation of data in the field to which it refers. It is of attractive form, and the material is well arranged. It will suffice to summarize its essential contents as follows, in which the reviewer has translated the titles from the original German:

Part 1: Induced Radioactivity by α-rays; Induced Radioactivity by Protons; Induced Radioactivity by Deuterons; Induced Radioactivity by Neutrons; Induced Radioactivity by Gamma-Rays.

Part 2: Tabular Presentation of all Stable, Natural and Induced Radioactive Isotopes with the most Important Data.

Part 3: Summary of all Stable, Natural and Induced Radioactive Isotopes, and the Transmutation Processes in Graphical Representation.

It is worth while calling special attention to the comprehensive chart contained in graph 3.

W. F. G. Swann

Bartol Research Foundation of
The Franklin Institute

NATURAL COLORING MATTERS

The Chemistry of Natural Coloring Matters. The Constitutions, Properties and Biological Relations of the Important Natural Pigments. By Fritz Mayer, Ph.D. Translated and revised by A. H. Cook, Ph.D. American Chemical Society, Monograph Series, No. 89. 6¼ × 9¼ in. 354 pp. Bound in dark blue cloth. New York: Reinhold Publishing Corporation. $10.00. 1943.

The book is divided into five chapters, each one of which has numerous references to the literature in the form of paginal footnotes. These chapters are: (1) Carotenoids (Polyene Pigments) (82 pp., 443 refs.); (2) Diaroylmethane Compounds (3 pp., 17 refs.); (3) Carbocyclic Compounds (59 pp., 240 refs.); (4) Compounds Containing Oxygen Heterocycles (108 pp., 512 refs.), and (5) Compounds containing Nitrogen Heterocycles (70 pp., 274 refs.). These chapters are followed by a brief General Bibliography, an Author Index and a Subject Index. The subject is presented compactly, access to further details being obtainable through the footnote references.

Paper, type, printing and binding are all excellent, and the book is profusely illustrated by constitutional formulas where structures are sufficiently well established to justify this. The tasks of the compositors and proofreaders in the case of some of the more complicated and extensive of these formulas must have been particularly laborious and difficult.

This masterly treatise, in the wealth of its documented information, its wide sweep and its up-to-dateness, is *facile princeps* among English books in its own chosen field. So far as the reviewer is informed, nothing at all comparable has appeared since the publication twenty-five years ago of Green and Everest's "The Natural Organic Colouring Matters." Between that date and this, the whole great field of the carotenoids, which is not even mentioned in Green and Everest's book, has experienced a marvelous development and elucidation. Carotene has been recognized as the precursor of the all-important vitamin A. The constitution of many of the carotenoids has been determined, as well as their exceedingly interesting chemical and biological relationships.

This carotenoid chapter also will enable the reader to see what has been contributed to this group since the appearance five years ago of a similar chapter in the first edition of Gilman's "Organic Chemistry."

Realms of still more recent exploration, which find a place in this new book, include the pigments of butterflies' wings, investigated by Wieland, Schöpf and their collaborators, and called by them "pterins." So that even the beautiful dazzling colors of butterflies and of certain insects have been unable to escape the insatiable prying curiosity of the chemist, who has proposed structural formulas for many of them.

Another and much more important field, which twenty-five years ago was largely a *terra incognita*, is that of the blood and bile pigments, to which Hans Fischer and his co-workers have made so many and such splendid contributions. The structural relationship of porphin to the phthalocyanine synthetic pigments of Linstead and his associates is a striking fact.

Curcumin, the principal pigment of turmeric, still remains pretty much in a class by itself (Chapter 2), so far as its chemical constitution is concerned.

Chapters 3 and 4 follow approximately the same general lines of chemical classification as Green and Everest, so far as the older natural pigments are concerned, and are enriched by many new compounds and illuminated by the light of numerous fresh investigations.

One of the chief contributing factors in the elucidation of the chemical nature of those natural pigments which are present so often in infinitestimal amounts has been the remarkable development of microchemical methods of all kinds, stemming from Pregl's pioneer work in the microanalytical field.

As noted in its sub-title, this book is concerned only with natural compounds possessed of visible color, *i.e.*, with pigments and not with dyestuffs as such. The tinctorial properties are incidental and not the governing factor in determining the appropriateness of including a colored compound. On the other hand, attention is constantly called to the absorbingly interesting biological relations and implications encountered.

The chemist will find in this book vistas into many new and fascinating worlds, often but little explored, which beckon alluringly and challenge the adventurous.

The book is warmly commended to all organic chemists. It is deeply to be deplored that the senior author could not have lived to see the fruition of his labors.

MARSTON TAYLOR BOGERT

SPECIAL ARTICLES

HUMAN COMPLEMENT[1]

THIS is a summary of a detailed study of human complement, including the structure and functions of the complement components.[2] The method used for the separation of the mid- and end-pieces of guinea pig complement proved to be inadequate for the separation of the corresponding portions of human complement. The method finally adopted consisted of dialysis of fresh human serum against a phosphate buffer of ionic strength 0.02 and pH 5.4. The dialysis is carried out with mechanical rotation at 1° C for 24 hours or longer, depending on the amount of serum employed. The precipitate, which corresponds to the mid-piece, is washed with cold phosphate buffer of ionic strength 0.02 and pH 5.4. If this precipitate is to be stored it is dissolved in a phosphate buffer of ionic strength 0.3 and pH 6.6.

The supernatant, which corresponds to the end-piece, is neutralized by the addition of 0.02 ml of 1N NaOH per ml, and made isotonic with 18 per cent. NaCl solution. The supernatant is best preserved at 1° C in 1:1.2 dilution in isotonic saline or in 1:2.5 dilution in phosphate buffer of pH 6.6 and ionic strength 0.3. The details of this method will be published elsewhere.

The mid-piece and end-piece obtained by this method are individually inactive but fully active when combined.

---

[1] Aided by a grant from the Commonwealth Fund.

[2] For earlier studies *cf.* Mackie, T. J.: *J. Immunology*, 1920, 5: 379; Osborn, T. W. B., "Complement or Alexin," London, Oxford Univ. Press, 1937.—Hegedüs, A., and Greiner, H., *Zeitschr. f. Immunitätsf.*, 1938, 92: 1.

The human complement in one ml of human serum can be deprived of its third component by incubation at 37° C for 1 hour with 1.35 mg of the insoluble carbohydrate of yeast ("zymosan") prepared in this laboratory.[3]

The fourth component is inactivated with 0.2 ml of 0.16 M ammonium hydroxide per ml of fresh serum. The mixture is first shaken and incubated for 1 hour at 37° C; neutralization is then carried out by the addition of 0.032 ml of 1 N HCl. The fourth component can also be inactivated with hydrazine (0.1 ml of 0.16 M hydrazine per ml of fresh serum).

Human complement is inactivated at 52° C for 30 minutes by virtue of the destruction of C′2.

In summary, human complement is composed of four components similar to but not entirely identical with the components of guinea pig complement. It was found that the third component (C′3) is the only component which is effectively mutually substitutive in human and guinea pig complement systems. This is the only component that has features suggestive of enzymic nature. Human C′1 has been purified by ammonium sulfate precipitation and phosphate buffer extraction. It is characterized as a euglobulin with an electrophoretic mobility of 2.9×10^{-5} in veronal buffer of pH 7.8 and ionic strength 0.1. This preparation of C′1 comprises 0.8 per cent. of the total serum proteins. A protein fraction comprising 1 per cent. of the total serum proteins and containing nearly all C′2 has been prepared.

Evidence has been obtained to show that the bactericidal action of human serum against *Vibrio comma* is a result of the joint action of complement and antibody; and that this bactericidal effect is destroyed by the inactivation of any one of the four components of complement. The bactericidal action is restored to a specifically inactivated complement by the addition to it of the particular component which it lacks. It has also been found that the bactericidal action of whole human complement against this vibrio can be fortified by the addition of the end-piece ($\mathrm{pH} = 5.4 - \mu\ 0.02$ supernate) of human complement.

Fixations of whole human complement and specifically inactivated human complements to viable sensitized *Vibrio comma* have been investigated. From whole human complement nearly all of the C′3 activity is removed during fixation and only small amounts of the activities of the other three components are removed.[4] However, sufficient amounts of the components are fixed so as to cause the destruction of the vibrios. From complement deprived of C′3, the other three components are fixed to the sensitized organisms but bactericidal action is not exerted. However, when C′3 is added to this complex, bactericidal activity occurs.

E. E. Ecker
L. Pillemer
S. Seifter
T. F. Dozois
C. L. San Clemente
Western Reserve University and
The University Hospitals

---

[3] *Jour. Biol. Chem.*, 137: 139. 1941.

[4] Human C′ has been found by Heidelberger and Mayer (*Jour. Exp. Med.*, 75: 285, 1943) to add roughly as much N to specific precipitates as does guinea-pig C′.

PIGMENT PRODUCTION BY SULFONAMIDE-RESISTANT STAPHYLOCOCCI IN THE PRESENCE OF SULFONAMIDES[1]

In a previous report[2] the *in vitro* and *in vivo* production of sulfonamide-resistant strains of staphylococci was described. During the past year, investigations have been carried out concerning the mechanism of this resistance. Ten additional resistant strains of staphylococci have been shown to produce a substance which inhibits the antistaphylococcic action of the sulfonamides. It has been found that this inhibitory substance has several of the properties of p-aminobenzoic acid (PAB). These observations confirm the report of Landy and his associates,[3] who studied two sulfonamide-resistant strains of staphylococci supplied by us, and with a microbiological assay concluded that the sulfonamide inhibitor produced by these strains was PAB.

A standard test has been utilized for determining the *in vitro* resistance of staphylococci to the sulfonamides. The organisms were grown for several generations in a water-clear synthetic medium.[4] One tenth cc of a 10^{-3} dilution of a 24-hour culture was added to a series of tubes containing 10 cc of the medium with varying concentrations of sodium sulfathiazole. The contents were incubated for 48 hours at 37 degrees C, and bacterial growth ascertained and expressed in terms of turbidity. The growth of non-resistant strains of staphylococci was completely inhibited by less than 1 mg per 100 cc of sodium sulfathiazole; whereas, a concentration of 200 mgs or more was necessary for the sulfonamide-resistant strains.

While the foregoing studies on sulfonamide-resistance were in progress, an interesting and reproducible phenomenon was observed. Control cultures of either non-resistant or sulfonamide-resistant strains of staphylococci in synthetic medium attained their maximum degree of growth within 24 hours of incubation. At the end of this time, and also following a more prolonged period of incubation, the contents of the culture tubes revealed a white, turbid suspension of organisms. In the presence of increasing concentrations of sodium sulfathiazole, the more resistant strains produced a yellow color, which first appeared at the end of 24 hours of incubation. If the cultures remained at incubator or room temperature for another 24 to 48 hours, the color became more intense. The color was so pronounced with some strains that a deep brown-orange pigment was observed. This pigment appeared only in the presence of the higher concentrations of the sulfonamide, and uniformly, shortly after maximum growth had been attained. Strains, whose growth was completely inhibited by 200 mgs per 100 cc of sodium sulfathiazole, showed pigment production occurring in the presence of 40 to 100 mgs concentrations of the drug. There was little or no inhibition of bacterial growth in the tubes showing the presence of the pigment. The pigment appeared also in the presence of sulfanilamide, sodium sulfapyridine and sodium sulfadiazine. It is of interest that strains 7 and 14, which were studied by Landy and his group, did not produce a demonstrable pigment. These strains are not highly sulfonamide-resistant.

---

[1] Aided by grants from the Charles P. DeLaittre Research Fund and from the Committee on Scientific Research of the American Medical Association.

[2] J. J. Vivino and W. W. Spink, *Proc. Soc. Exp. Biol. and Med.*, 50: 336, 1942.

[3] M. Landy, N. W. Larkum, E. J. Oswald and F. Streightoff, Science, 97: 265, 1943.

[4] G. P. Gladstone, *Brit. Jour. Exp. Path.*, 18: 322, 1937.

The nature of this pigment is being investigated at the present time. The pigment is not of the usual type produced by many strains of staphylococci, since it is not soluble in fat solvents. Evidence at hand would indicate that the pigment is derived from PAB. It would appear that under the experimental conditions described, some strains of staphylococci reproduce readily in the presence of the sulfonamides because of the synthesis of significant amounts of PAB. After maximum growth has been attained, the PAB is changed from a colorless state to a yellow-brown pigment.

WESLEY W. SPINK
JEAN JERMSTA VIVINO
UNIVERSITY OF MINNESOTA
HOSPITAL AND MEDICAL SCHOOL

INTRA-OCULAR VIRUS INFECTIONS

IN investigation of the virus of epizootic fox encephalitis[1,2] we have found that the method of intra-ocular injection is a most useful procedure. This technique appears to be of great potential value in the study of other virus diseases. Observations of infections resulting from intra-ocular injections have been reported by a number of investigators in the virus field, principally in work on the pathogenesis of infections of the nervous system. It is felt, however, that the possibilities of this procedure have not been fully utilized in the approach to the more common problem of demonstrating the presence of viable virus.

Fox encephalitis can be experimentally transmitted to dogs, wolves and foxes. Evidence of infection has, in the past, consisted in death of the animal with characteristic symptoms and the demonstration of inclusion bodies in vascular endothelium in the brain and elsewhere. Studies of fox encephalitis have been hampered by a low or variable mortality of inoculated animals. This ranged from 10 to 80 per cent., depending upon the virulence of the strain of virus used and the natural resistance of the animals injected. Accurate titration of the amount of virus in tissue suspensions and the titration of antisera have been wholly impracticable, since the large number of foxes or dogs required was prohibitive. Employment of the simple technique of intra-ocular injection has changed this picture completely. Intra-ocular inoculation results in 100 per cent. infection of the eyes of foxes; the infection is easily observed grossly and is readily confirmed by demonstration of the inclusion bodies in smear preparations. Previously a 1 to 10 per cent. tissue suspension has been used[3] as an inoculum, but it has now been found that each of the several stock tissue suspensions tested was fully infective by intra-ocular inoculation in a dilution of 1 part in 100,000.

About 0.2 ml. of virus is injected into the anterior chamber after aspiration of a slightly greater volume of aqueous humor. Infection from the fox encephalitis virus is usually apparent grossly by the third day, and in all cases there is a diffuse opacity of the cornea on the fifth day. A significant amount of purulent conjunctival exudate is not seen unless bacterial infection has occurred.

On the fifth day the eye is removed either under anesthesia or after the animal has been killed. Aqueous humor is aspirated with a Pasteur pipette for bacterial culture. Inclusion bodies are demonstrated in the endothelial cells that line the internal surface of the cornea by the technique routinely employed in making smears of the epithelium of the urinary bladder in the diagnosis of canine distemper.[4] Using a modified Shorr's stain,[5] we have frequently found more than half of the cells in a smear to contain large inclusion bodies.

Neutralization tests are carried out by injecting mixtures of serum and virus dilutions into the anterior

---

[1] R. G. Green, N. R. Ziegler, B. B. Green and E. T. Dewey, *Am. Jour. Hyg.*, 12: 109–129, 1930.

[2] J. C. Barton and R. G. Green, *Am. Jour. Hyg.*, 37: 21–36, 1943.

[3] R. G. Green, N. R. Ziegler, E. T. Dewey and J. E. Shillinger, *Am. Jour. Hyg.*, 14: 353–373, 1931.

[4] R. G. Green and C. A. Evans, *Cornell Vet.*, 32: 190–193, 1942.

[5] W. G. Page and R. G. Green, *Cornell Vet.*, 32: 265–268, 1942.

chamber of the eye. The results are clear-cut and unequivocal, and may be verified by examination of smears. Exploration of the range of susceptible species of animals has been greatly facilitated by intra-ocular injection of virus. The raccoon, previously considered resistant to fox encephalitis, has been easily infected by this method. These results indicate that some viruses may be isolated and transmitted by intra-ocular inoculation of animals that are resistant to inoculation by other routes.

The eye contains many types of cells and is susceptible to a great variety of viruses. In a survey of the effects of intra-ocular injection, it has been found that infection is visible grossly in the eyes of rabbits when the animals otherwise appear well in equine encephalomyelitis, ornithosis[6] and several other virus diseases.

Failure to cause *visible* infection of animals that are susceptible (capable of supporting the multiplication of virus) is an obstacle to work with many virus diseases other than fox encephalitis; in some of these, as in fox encephalitis, intra-ocular injection should prove of great value. It appears that this may be a successful method for the initial demonstration of some viruses.

Charles A. Evans
H. Y. Yanamura
R. G. Green
University of Minnesota Medical School

SCIENTIFIC APPARATUS AND LABORATORY METHODS

PREPARATION OF METHIONINE AND TRYPTOPHANE-FREE CASEIN HYDROLYSATES[1]

Toennies and Kolb[2] have shown that methionine is selectively oxidized by hydrogen peroxide in the presence of perchloric acid. More recently, Toennies[3] has found that the methionine in casein is rendered biologically inactive by peroxide oxidation of the whole protein dispersed in formic acid. The concurrent observation made in this laboratory that methionine is also selectively oxidized by hydrogen peroxide in the presence of 30 per cent. sulfuric acid has been found to afford the simple and inexpensive procedure for the preparation of a methionine and tryptophane-free casein hydrolysate to be described.

One kilogram crude casein was hydrolyzed under reflux for 20 to 23 hours with a mixture of 500 ml concentrated sulfuric acid and 1 liter of water. After cooling to 80° C., 200 ml of 30 per cent hydrogen peroxide (technical) was added and the mixture allowed to stand 24 hours at room temperature. Now, 2 liters of water and 4 liters of 16 per cent. calcium oxide suspension were added. The slightly alkaline mixture was thoroughly stirred and resulted in the evolution of ammonia. After standing overnight, it was filtered through a norite-precoated filter and the resulting calcium sulfate cake resuspended in 2 liters of hot tap water. This mixture was stirred mechanically for 30 minutes, filtered and the combined filtrate and washings concentrated *in vacuo* at 50–60 ° to approximately 2 liters. The resulting ammonia-free concentrate was made neutral to litmus with 50 per cent. sulfuric acid, cooled under the tap and filtered.

The protein equivalence (N × 6.25) of the preparation was estimated from micro-Kjeldahl analysis of a suitable aliquot. Approximately 650 grams of methionine and tryptophane deficient product were obtained. The methionine content of the final product by the method of Kolb and Toennies[4] varied from 0.12–0.21 per cent. of the protein. No tryptophane could be detected.[5] Histidine, arginine, threonine and serine determinations indicated that these amino acids had not suffered any destruction by the treatment.

For use in a methionine deficient rat diet[6] the solution was supplemented by 1.5 per cent. l-tryptophane and 1 per cent. l-cystine. Bioassay in rats showed that the weight loss incurred by feeding the methionine deficient product as the protein moiety (14.7 per cent.) of the diet was regained and normal growth resumed on supplementation of the diet by 3 per cent. d-l methionine.

Anthony A. Albanese
Department of Pediatrics,
Johns Hopkins University

---

[1] This investigation was aided by grants from the Rockefeller Foundation, Merck and Company and E. R. Squibb and Sons.

[2] G. Toennies and J. J. Kolb, *Jour. Biol. Chem.*, 140: 131, 1941.

[3] G. Toennies, *Jour. Biol. Chem.*, 145: 667, 1942.

[6] J. M. Stickney and F. R. Heilman, *Proceedings of the Staff Meetings of the Mayo Clinic*, 17 (24): 369–375, 1942.

[4] J. J. Kolb and G. Toennies, *Ind. and Eng. Chem. Analyt. Ed.*, 12: 723, 1940.

[5] A. A. Albanese and J. E. Frankston, *Jour. Biol. Chem.*, 144: 563, 1942.

[6] A. A. Albanese and W. Buschke, Science, 95: 584, 1942.

BOOKS RECEIVED

Ickes, Harold L. *Fightin' Oil.* Illustrated. Pp. x + 174. Alfred A. Knopf, Inc. $1.75.

Metcalf, Z. P. *General Catalogue of the Hemiptera.* Pp. 552. Smith College.

O'Hara, Dwight. *Air-Borne Infection.* Illustrated. Pp. 114. The Commonwealth Fund. $1.50.

Richter, George Holmes. *Textbook of Organic Chemistry.* Pp. vi + 759. John Wiley and Sons. $4.00.

Woody, Clifford. *The Discipline of Practical Judgment in a Democratic Society.* Pp. viii + 268. The University of Chicago Press. $2.00.

Young, Paul Thomas. *Emotion in Man and Animal.* Illustrated. Pp. xiii + 422. John Wiley and Sons. $4.00.

SCIENCE

VOL. 98 FRIDAY, JULY 16, 1943 No. 2533

The Advancement of Science in China during the Past Thirty Years: CHUNGSHEE H. LIU ... 47

Obituary:
Dr Leonhard Stejneger: PAUL BARTSCH. *Deaths and Memorials* ... 51

Scientific Events:
The Birthrate of Great Britain; The Botanic Garden of the University of Cambridge; Recommendations for the Care of the Medically Indigent; New and Rare Instruments; The Virginia Academy of Science Research Endowment ... 55

Scientific Notes and News ... 57

Discussion:
Continental Drift and Ancient Dunes: JOHN R. PETERS. *Some Paleontological Inferences as to the Life-habits of the Australopithecines:* PROFESSOR LOREN C. EISELEY. *"Dormant" Versus "Adventitious" Buds:* EARL L. STONE, JR. and MARGARET H. STONE. *Acidity and Activity of Sulfonamides:* DR. I. M. KLOTZ. *Correction:* DR. MICHAEL HEIDELBERGER and CATHERINE F. C. MACPHERSON ... 60

Scientific Books:
Physiological Chemistry: PROFESSOR HENRY BORSOOK. *Modern Physics:* PROFESSOR LEIGH PAGE ... 63

Special Articles:
Demonstrating the Presence of Sulfonamides in the Tissues: COMDR. MARION B. SULZBERGER, M.C., U.S.N.R. and OTHERS. *Ether and Metabolism in the Cerebral Cortex:* DR. FRANCIS N. CRAIG ... 66

Scientific Apparatus and Laboratory Methods:
Large-scale Production of Penicillin: PROFESSOR C. E. CLIFTON ... 69

Science News ... 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE ADVANCEMENT OF SCIENCE IN CHINA DURING THE PAST THIRTY YEARS

By CHUNGSHEE H. LIU

EDITOR, THE *K'o Hsüeh (Science)*, THE SCIENCE SOCIETY OF CHINA, SHANGHAI

I

EVER since the establishment of the Republic of China on October 10, 1911, the development of science in this country has entered a new era of activities in its own history. Unlike the early Ming and the late Ch'ing dynasties,[1] when science was superficially introduced into China, this time we have fostered modern-science from quite a different point of view and on a solid foundation. Characteristic features are easily to be noted. Firstly, scientific researches along various branches of science were duly initiated. Original work undertaken at institutes, laboratories and universities made valuable contributions to modern science either of universal nature or of local character. Secondly, since the beginning of this new period, the work of developing science has been entirely entrusted to the Chinese themselves, although a few foreign institutions inherited from the last century were still to be seen in the country, but were not very active. Thirdly, a large number of Chinese scientists, both trained abroad and at home, have served the country in various capacities—in government departments and private institutions. Fourthly, scientific education has received ever so much attention and considerable progress has been observed. Scientific courses were not only taught in schools, colleges and universities, but also gained an important position in their respective curricula. Fifthly, the application of science in various walks of life shows another phase of scientific activities from daily life to national defense. With the rapid development of science in China, we have every reason to believe that the Chinese people have by now learned how to appreciate the nature of scientific truth and to acquire the technical method. Gradually they become scientifically minded. As a social institution and an academic learning, science has, indeed, steadily taken root in China with bright outlook and hopeful prospects.

---

[1] Chungshee H. Liu, *The China Journal*, 34: 3, 120–125; 5, 210–219, 1941.

Chronologically speaking, the foremost scientific research institution of its kind is undoubtedly the National Geological Survey of China, which was founded in 1916 by the Ministry of Agriculture and Mines at Peiping, then known as Peking. Under its two former distinguished directors, the late Dr. V. K. Ting and Dr. Wen-hao Wong, now China's war-time Minister of Economic Affairs, it has developed into an institution of national importance which attracted world-wide notice in 1929 with the discovery of the "Peking Man," or *Sinanthropus pekinensis.* From the very beginning, the Survey devoted itself to the economic field and undertook nation-wide plans for reconnoitering mineral deposits and carried out geological mapping, including paleontological researches. As a result of the work of a number of young Chinese geologists, many new discoveries were made and proved to be of value to science, not to mention their economic importance. This is best evidenced by the Survey's several serial publications, such as the *Palaeontologia Sinica, Geological Bulletin, Geological Memoirs, Soil Bulletin,* etc. The Survey has also taken up allied responsibility not usually entrusted to geologists. These include seismology, soil survey, fuel research and prehistoric studies; for the last subject the Laboratory for Cenozoic Research was established in 1927 for the purpose. Indeed, during the past twenty-five years this earliest scientific institution of China has made notable contributions to our knowledge of this part of the earth and has established a well-earned reputation in the scientific world.

II

After geology, biological sciences came into the limelight. About twenty years ago, Dr. C. Ping and Dr. H. H. Hu, professors of zoology and botany, respectively, in the Teachers College at Nanking, began to study the fauna and flora of China. Apart from fulfilling their academic duties, they led or planned expeditions from time to time to different regions of the country—from Mongolia and Manchuria in the north to Hainan Island in the south, from the China Seas in the east to the Tibetan Plateau in the west—to collect animal and plant specimens of which many new genera and species, even new families, have been discovered, hitherto unknown to science. By so doing they improved the teaching facilities and paved the way for research on the one hand and trained a large number of young biologists on the other.

In 1922 the Biological Laboratory of the Science Society of China was inaugurated, although the society itself was founded in 1914, the forerunner of its kind in this country. After a hard struggle for several years, the laboratory soon gained recognition of the learned circles of the country, and since 1925 the China Foundation for the Promotion of Education and Culture has made grants to the society for maintaining the activities of the laboratory. Now it has become one of the most important institutions for biological researches in China and is well known to the biological world through its hundreds of exchange publications—*Contributions, Icones* and *Monographs*—with foreign countries the world over. After twenty years of pioneer work, Dr. Ping, the founder of Chinese scientific zoology, still remains as its director and, at the same time, a godfather to many other affiliated institutions.

In 1928, thanks to the moving spirit of Dr. Ping, the China Foundation again helped to establish the Fan Memorial Institute of Biology in Peiping, and he became its first director. Under the experienced guidance for a number of years of Dr. H. H. Hu, the founder of Chinese scientific botany and now president of the National Chiang Kai-shek University, the institute has become one of the best, if not the best, of the scientific organizations of China. It possesses a well-equipped modern building with fine laboratories, a herbarium and a museum of its own. It issues bulletins in two series—zoological and botanical—which have a wide circulation all over the world. It was by this institute that the *Zoölogia Sinica* was published.

Since then, under the joint leadership of Dr. Ping and Dr. Hu, the biological sciences have been enhanced; considerable progress has been made and an enormous amount of work has been done on taxonomy, morphology, physiology, genetics and bio-chemistry, as well as in the economic field. In this connection mention must be made of the Botanical Institute of the National Sun Yat-sen University at Canton, which is devoted entirely to systematic botany with a well-arranged herbarium and good library under the direction of the eminent botanist, Professor Woon Yung Chun, whose knowledge of the botany of South China, especially Hainan Island, is second to none in China, if not in the world. *Sunyatsenia,* the official organ of the institute, enumerates all the achievements and results of the valuable research work sponsored by the institute. As time went on, there were a number of other biological institutions, such as the Entomological Bureau of Kiangsu, Chekiang, Kiangsi and Kwangtung, the Lushan Arboretum, the Tsingtao Aquarium, the Marine Biological Stations at Amoy and Tsingtao, Oceanographical Survey at Tinghai, Chekiang, etc.

III

But the most important landmark in Chinese scientific research was undoubtedly the establishment of the Academia Sinica, or National Academy of Sciences, soon after the formation of the National Government at Nanking in 1927. According to its charter the Academia Sinica is the highest institution for scientific research in China, designed as a sort of Académie des Sciences, U. S. National Research Council, Department of Scientific and Industrial Research of Great Britain and Kaiser-Wilhelm Gesellschaft combined. Unlike all the other institutions, it is independent of political control, for it does not rank under any ministry or board, but is directly responsible to the national government, which means the President of the Republic. It also functions as the highest national organization for conferring honors upon distinguished scientists and scientific institutions both at home and abroad. For the purpose of directing and coordinating scientific activities in China, there is a council consisting of thirty members, selected from among the scientific workers of the country and a number of *ex-officio* members who have the right to elect candidates for the presidency of the Academia Sinica.

As constituted at present, the Academia Sinica controls ten research institutes, including those of astronomy, meteorology, physics, chemistry, zoology and botany, geology, psychology, engineering, history and philology (including archeology and anthropology), and social sciences. Thus the scope of research is extremely wide; for, on the one hand, it includes such routine service as meteorology, which is usually undertaken by a government bureau; on the other, it embraces history and philology, which are usually considered as belonging to the "humanities," not to say social sciences.

It would be idle to go into details to enumerate the research works carried out by these ten national research institutes. However, a few words on each institute may not be superfluous. In addition to compiling the almanac, supplying time service and determining longitudes and latitudes, the Institute of Astronomy (Professor Y. C. Chang, director), carries out regular photometric and spectrophotometric studies of the sun, the planets and the stars. It also makes observations of variable stars and studies solar activities with the Hale spectrohelioscope. The Institute of Meteorology (Dr. Coching Chu, the pioneer of modern Chinese meteorological research work, director) possesses up-to-date equipment and maintains a seismological station. It has a radiotransmitting station of its own and broadcasts its forecasts daily. The institute keeps in close touch with provincial meteorological stations all over China and those in the Far East. It maintains several branch stations of its own, including one at Chinghai (Kokonor) and another at Lhasa, the capital of Tibet. For upper-air investigations, flights were usually made in cooperation with the National Bureau of Aviation.

The Institute of Physics (Professor H. L. Ting, director) concentrates on researches in wireless, x-rays and geophysical surveying. It maintains a well-equipped workshop for manufacturing scientific instruments, including microscopes, electrical and surveying apparatuses for the use of various schools and scientific institutions. The work carried out by the Institute of Chemistry (Dr. H. C. Woo, acting director) paid more attention to local problems than pure research. Thus, work has been done on Chinese drugs, paper and glass-making, metallurgy of certain rare minerals. The efforts being made by the Institute of Engineering (Jen Chow, director) are on ferrous metallurgy and ceramics with the purpose of better utilization of China's resources in industrialization. Cooperating with the Physics Institute, it maintains standards testing laboratories and thus it fulfils partly the function of a bureau of standards.

The Institute of Geology (Dr. J. S. Lee, an internationally known geologist, director) has four sections: stratigraphy and paleontology, petrography and mineralogy, economic geology, dynamic geology and geophysics. Thus, its work is more on the theoretical side than practical. In cooperation with the National Geological Survey it has also done considerable mapping, especially in the Lower Yangtse Valley. Its publications have also gained international recognition. The Institute of Zoology and Botany (Dr. C. C. Wang, a distinguished young zoologist, director) was originally the Metropolitan Museum of Natural History. It devoted itself exclusively to faunal and floral studies, especially of South and Southwest China. At present, the institute concentrates on taxonomy, economic entomology and plant pathology besides paying special attention to fishery. It took an extensive oceanographic survey in the East China Sea and the Gulf of Chihli. The Institute of Psychology (Mr. G. H. Wong, director) is the smallest and at present its work is largely confined to neural physiology and anatomy.

For "humanities" and social sciences, the Institute of History and Philology (Ssu-nien Fu, director) is quite misnamed, for it is better known by its archeological and anthropological works. For a number of years, it carried out excavation work in Northern China, especially in the Shang capital at Anyang, where discoveries of inscribed bones and shells, bronze, pottery, stone implements and stone carvings belonging to different periods of culture were made. By means of these discoveries, ancient Chinese history, hitherto disputed, is being checked and verified.

Again, the Anthropological Section, under the capable direction of the famous anthropologist and statistician, Dr. T. L. Woo, maintains an excellent anthropometric laboratory and considerable work on measurements, both on the living and on skeletons, has been done. The recently founded *Anthropologia Sinica* is its official organ of publication. Moreover, the Philological and Historical Sections of the same institute have also issued some publications. Like the "humanities" institute, the Institute of Social Sciences (Dr. L. K. Tao, director) had four sections: those of law, economics, sociology and ethnology. However, in 1934, it was amalgamated with the Institute of Social Survey of the China Foundation. Thus reorganized, the new institute devotes itself entirely to economic studies with regard to which some publications have already appeared.

IV

So much for the Academia Sinica. In 1929, another group of research institutes under the Academia Peipinica was organized by the Ministry of Education. This was intended to serve the same purpose as the Academia Sinica, but with a much smaller budget and in different geographical centers. So far, it has maintained six institutes, namely, those of physics, chemistry, zoology, botany, physiology and pharmacology, all of which were located in Peiping except that the Physics Institute (Dr. Ny Tsi-zé, director) has a branch known as the Radium Institute in Shanghai. Like other institutes, they also issue their scientific bulletins.

Other research institutions which deserve mention are the National Agricultural Research Bureau and the National Industrial Research Bureau, both of which are patronized by the Ministry of Economic Affairs. Medical researches are undertaken by the Central Field Health Station, which has done good work on cholera vibrio, the larvacide value of various chemicals, enrichment of soybean milk, the toxicity of habit-forming drugs and the like. It will become the focus of all medical research in connection with public health in China.

Furthermore, some of the scientific institutions under foreign control are worthwhile mentioning in this connection. For instance, the Peiping Medical Union College, supported by the Rockefeller Foundation, has had a considerable influence on Chinese medical research and education, while the Obsérvatoire de Zikawei, Musée Heude, Institute Pasteur de Changhai, the Henry Lester Institute for Medical Research and the Shanghai Science Institute, all located in Shanghai, have done their part in contributing to science.

It is needless to say that research work is also being done in various universities where graduate schools have been steadily organized. In quantity it is naturally less than that of the special research institutions, but its importance is increasing. This shows that a modern Chinese university is organized on just the same plan as those to be found in Western countries and its standing has been raised to a high level. In other words, Chinese scientific education to-day has made considerable progress in comparison with thirty years ago.

Another phase of activities showing the progress of science in China was the flourishing of scientific societies. As mentioned before, the first scientific body ever organized in this country was the Science Society of China, founded in 1914, which is devoted to "the diffusion of scientific spirit and knowledge among the Chinese people, the active participation in scientific research, and the encouragement in their practical application so as to lay a firm foundation for scientific growth and industrial prosperity of the nation as well as contributing to the welfare and progress of the world." For a little more than a quarter of a century, the society has, through its official organ, the *K'o Hsüeh* (*Science*), a semi-technical monthly, made considerable contributions to the promotion of scientific knowledge and cultivation of scientific environment among the people. Before long, the society gained a nation-wide reputation and its members, numbering thousands, are distributed not only throughout the country, but also all over the world.

Other scientific bodies of a general character, such as the Chinese Society of Science and Arts, the Natural Science Society of China and the China Scientification Movement Association, have likewise done some service to the country. Respectively, they have issued *Wissen und Wissenschaft*, *Scientific World* and *Scientific China* as their official organs.

In addition to the general science organizations, special scientific societies have been formed one after another. As they are too many to enumerate here, we may only mention those whose activities are better known. For pure science, there are the societies of geology, physiology, astronomy, meteorology, physics, chemistry, botany, zoology, geography, mathematics, ethnology, marine biology, etc. All of them have issued their own journals, proceedings or transactions of a high order in Chinese or in European languages. As far as applied science is concerned, there have been no less than 28 societies or associations established belonging to engineering, agricultural and medical sciences. Most of them have their own publications. It is significant that all the above-mentioned societies are purely Chinese in character, although there may be a few foreign members among their members. In order to coordinate scientific activities among various branches of sciences, annual conferences or joint meetings have taken place year by year and from city to city throughout the country.

V

With regard to the application of science either to the development of industry and agriculture or the welfare of the people, it is obvious that during the past thirty-odd years China has made marvelous advancement in various aspects by the benefit of science. As individual cases are too many to enumerate, we may say in general terms that many modern industrial enterprises have been undertaken on a scientific basis or under scientific management. While heavy industries are still awaiting development in this country, light industries, such as cotton mills, pharmaceutical works, etc., have already made considerable advancement in large cities and seaports like Shanghai, Hankow, Chungking, Canton, Tsingtao and Tientsin. Meanwhile, most of the mining industry has been operated according to scientific methods and management. Scientific agriculture has also been introduced in many fields, such as the improvement of breeding of various crops like cotton, rice and wheat. Reforestation, horticulture and sericulture have also recorded an appreciable improvement.

In the field of engineering sciences, most of the Chinese railways were constructed within the past thirty years, while highways have been rapidly extended during recent years. Scientific hydraulic engineering has replaced the old methods in water conservation works and canaling. Electricity has been employed in various places for different purposes, not only in the telephone and telegram services, but also in a number of ways in the daily life of the people, such as for electric lights, the cinema and the radio. Moreover, machines have been used in numerous ways. In a word, the whole Chinese nation has gradually been transformed from the handicraft stage to a modern machinery age, in so far as the daily life is concerned.

It should be noted, however, that what we have stated in the above paragraphs was merely the advancement of science in China from the beginning of the Republic up to the time when the so-called "China Incident" occurred. During the past four eventful years scientific activities have been speeded up along various fields in the interior provinces. Great efforts are being exerted in biological expeditions, geological surveys, mineral reconnoitering, engineering reconstructions, agricultural improvements, ammunition manufacturing and what not, not to mention laboratory research, with one noble purpose, namely, to meet the wartime need of the nation. The details of these works need not concern us here.

In conclusion, it is no exaggeration to say that during the past thirty years of the Republic, science alone has seen tremendous progress in many sides. Comparing the shortness of time with what has been accomplished, we have at least this feeling of satisfaction that science has become deeply rooted in Chinese soil and our scientists have proved competent for their task in making valuable contributions to modern science and have done good service to the country which was and is urgently needed. The people as a whole have heartily recognized the advantage of the application of science. Therefore, from a historical and scientific point of view, the past thirty years have been a most important and memorable period in Chinese history. With the help of science, we are confident that we shall be able to rejuvenate our nation and reconstruct our country.

OBITUARY

DR. LEONHARD STEJNEGER

October 30, 1851–February 28, 1943

THE stimulating endeavors of Spencer F. Baird, the second secretary of the Smithsonian Institution, attracted not only the naturalists and embryo-naturalists of our own country to this institution of learning, but similarly gifted individuals from abroad came to seek their fortunes at this seat of scientific endeavors. It was Baird's splendid leadership and discernment of men of ability and lack of self-seeking that eventually surrounded him with a staff of scientific men probably unequalled anywhere at any time before. However, this is not intended to be a eulogy of Baird, but a simple appraisal of a great naturalist attracted to our shores by the rapidly spreading fame of the Smithsonian Institution.

Dr. Stejneger was born in Bergen, Norway, on October 30, 1851, the son of Peter Stamer and Ingeborg Catharina (Hess) Stejneger.

From early youth, Stejneger was bitten by the naturalist bug. I have seen a set of his childhood drawings in color of birds of his region which would do credit to an artist of maturer years.

His mother's delicate health requiring a milder winter climate than that afforded by their northland home caused the family to winter in Meran (South Tirol), where we find Stejneger extending his ornithological observations as evidenced by his first published contribution, "Ornithologische Notizen ans Meran, Süd Tirol, wahrend der Winter 1869, 1870, und 70–71."[1] This contribution was followed by a number of well-illustrated popular papers on the birds of Norway, and then reports upon birds collected by the Norwegian Mission to Madagascar, the specimens of which were in the Bergen Museum, which yielded him his first new species. All in all, 22 papers had issued from his pen when he left his native land. His interests were not confined to birds, for he was equally well versed in the lore of the other vertebrates, and even invertebrate denizens of land and sea had received more than a passing attention; in other words, he belonged to that group of naturalists whose broad vision at that stage of our knowledge enabled them to have a comprehensive view of the entire zoological field.

---

[1] *Jour. Ornith.*, pp. 122–124, 1871.

It is interesting to note how his educational endeavors, which were not intended to make him a professional naturalist, nevertheless contributed to make him the helpful and outstanding taxonomist and nomenclatorist into which he developed. 1859–60 were spent at the Smith Theological School in Bergen. In 1860–69 he attended Bergen's Latin School. In 1869–70 he was under private tutorship at Meran. In 1870 he entered the University of Christiania as candidate in art, and in 1872 as candidate in philosophy, and finally, in 1875, as candidate in law. Here may be added a Ph.D. *honoris causa* conferred upon him by the same university in 1930.

These studies gave him a splendid command of the classic Greek and Latin and modern languages, and his legal training the outlook which made him a power in questions of nomenclatorial procedure (he served on the International Commission of Zoological Nomenclature from its beginning to his death), while his artistic endeavors furnished that care to detail which has characterized all his work.

Europe with its meager returns to naturalists caused him to look to America as the land of promise, and we therefore find him at the portals of the Smithsonian Institution in the fall of 1881.

Baird, recognizing ability and appreciating Stejneger's knowledge of the Palearctic fauna, saw his opportunity to have the right man in the field to expand our knowledge of the far northwest Pacific fauna and flora. In his usual persuasive way, he showed the U. S. Signal Service how important and necessary it was for it to have an observer on weather in those regions, pointing out that he had just the right man for that job. I fear, however, that the possibility of securing remains of Steller's sea cow and possibly some specimens of Pallas' cormorant (also found to be extinct), to say nothing of the many other things that a young energetic naturalist might secure, may have weighed strongly in having Stejneger appointed observer in the U. S. Signal Service.

Stejneger as U. S. signal observer left Washington on March 22, 1882, arriving on May 7 at Bering Island, where he established a signal station, trained an observer and on June 16 sailed for Petropaulowski, Kamchatka, to establish another signal station. This done, he returned to Bering Island, where he spent the winter. In the fall he circumnavigated Bering Island, visiting the site of the ill-fated Bering Expedition. An interesting account of this trip, well illustrated with sketches and maps, was published in the *Deutsche Geographische Blätter* (Vol. 8, pt. 3, 1885).

In May, 1883, he revisited Petropaulowski, and in the summer went to Copper Island to study the habits of the fur-seals whose large rookeries were being exploited by the Alaska Commercial Company. He then returned to Bering Island, from where upon the completion of his work he returned to the United States, arriving at the Smithsonian Institution on October 29, 1883.

The Annual Report of the Board of Regents of the Smithsonian Institution for 1883 (1885) gives a fine account of the splendid results of this expedition, which must have given great pleasure to Secretary Baird as well as to the collector.

In 1884 we find him as assistant curator, Department of Birds, U. S. National Museum, busy upon a general account of his northern expedition and sundry other papers, foremost among which were his "Results of Ornithological Explorations in the Commander Islands and in Kamchatka[2] and Volume 4, "Birds" of the Standard Natural History, published by S. E. Casino and Company in 1885.

Overwork carried the usual syndrome of manifestations and resulted in Stejneger being sent to Arizona to join Dr. C. Hart Merriam, who was making his studies of the life zones of the San Francisco Mountains.

His stay there resulted not only in the recovery of his health, but also in the securing of a mass of information in the field that was to embrace his major attention during the rest of his days—herpetology—for Stejneger was appointed curator of reptiles of the U. S. National Museum on March 1, 1889.

In 1895 Dr. Stejneger was detailed to the U. S. Fish Commission as attaché to revisit the Russian Fur-Seal Islands and report on the existing conditions of their herds. He accordingly left Washington on May 28. He reached St. Paul Island (Pribilof group) on June 25, where a special seal drive was arranged for him next day to acquaint him with local killing methods; the next day he left for Bering Island, which he reached on July 3. From this date to September 24 his time was spent in gathering data and photographing the herds of Bering and Copper Islands, the

[2] *Bull. U. S. National Museum*, 29: 1–382, pls. i–viii, 1885.

results of which were embodied in his exhaustive report on "The Russian Fur-Seal Islands.[3]

This masterful treatise made him a marked man in fur-seal matters. It is therefore not surprising that, when Congress ordered "a scientific investigation during the years of 1906 and 1907 of the present conditions of the fur-seal herds on the Pribilofs, Commander and Kuril Islands in the north Pacific and Bering Sea," Stejneger by Presidential order was called to take part in these investigations.

We therefore again find him on the Russian fur-seal islands, as well as on the Japanese Robben Islands in the Okhotsk Sea in 1896 and 1897. His major contribution to the reports of the commission are contained in Part IV, "The Asiatic Fur-Seal Islands and Fur-Seal Industry."[4]

His last visit to the northern isles was made in 1922 when the Department of Commerce requested his detail to assist in obtaining exact information on the status of the fur-seal herds on the Russian and Japanese seal islands, in order to determine the effect of the treaty of 1911 entered into by the United States, Russia, Japan and Great Britain for the protection of the fur-seals of the north Pacific Ocean.

His report is contained in "Fur-Seal Industry of the Commander Islands."[5]

Here, as the culminating effort of his northern explorations, should be mentioned his volume on "Georg Wilhelm Steller, the Pioneer of Alaskan Natural History."[6] The fascinating account of this naturalist was inspired by Stejneger's first visit to Bering Island. From that time on he lost no opportunity to trail this man from birth to death, by the search for information from relatives, church records, official documents, museum specimens and the maze of publications resulting from the collections and notes made by Steller. All this information Stejneger has woven into a reconstruction of the conditions of the times and the environment, both human and otherwise, with its trials, tribulations, hardships and joys under which this energetic and able naturalist accomplished remarkable results.

Stejneger's first love, like that of many other naturalists, was birds. We therefore find his early contributions dealing with avian topics. After his appointment to the curatorship of reptiles there is a rapid transition in his writings to the herpetological field. His first reptile paper, "Description of Two New Species of Snakes from California," was published in the Proceedings of the U. S. National Museum, Vol. 12, pp. 95–99, October, 1889.

1895 saw the issuance of his "Poisonous Snakes of North America."[7]

Our acquisition of Puerto Rico following the Spanish-American War inspired our government to explore its resources, which resulted, among other endeavors, in a visit by Dr. Stejneger to that island to study its herpetologic treasures. February 12 to April 19, 1900, was devoted to collecting in the islands of Puerto Rico and Vieques. The results of this expedition are embodied in "The Herpetology of Puerto Rico."[8]

His next comprehensive efforts are embraced in his "Herpetology of Japan and Adjacent Territory."[9] In 1917, in collaboration with Thomas Barbour, he published "A Checklist of North American Amphibia and Reptiles,"[10] of which the fifth edition is now going through press. A timely and interesting account, "A Chapter in the History of Zoological Nomenclature,"[11] appeared in 1924.

An examination of Dr. Stejneger's bibliography reveals a total of 411 titles, of which 152 pertain to herpetology, while 146 deal with birds, 30 with explorations and 16 are devoted to mammals and the rest scattering.

In 1911 Stejneger was appointed head curator of biology, U. S. National Museum.

Stejneger attended eight International Zoological Congresses, seven of them as delegate of the Smithsonian Institution: 4th Cambridge, 1898; 5th Berlin, 1901; 6th Berne, 1904; 7th Boston, 1907; 9th Monaco, 1913; 10th Budapest, 1927; 11th Padua, 1930, and 12th Lisbon, 1935.

In 1898 he spent four and one-half months in Europe studying museums and specimens and also attended the International Fisheries Exposition at Bergen, Norway. In 1905 he was a delegate of the Smithsonian Institution at the Fourth International Ornithological Congress in London and the Internal Convention of the International Catalogue of Scientific Literature. In 1907 he was a delegate of the U. S. National Museum at the International Fisheries Congress at Washington. In 1911 he represented the Smithsonian Institution at the five hundredth anniversary of the founding of the University of St. Andrews, Scotland. In 1911 he represented the

---

[3] *Bull. U. S. Fish Comm.*, art. 1, pp. 1–148, pls. 1–66, 1896.

[4] "The Fur-Seals and Fur-Seal Islands of the North Pacific," Pt. 4, pp. 1–384, pls. 1–117 and maps. Government. Washington. 1898.

[5] *Bull. Bur. Fish.*, 41: 287–332, figs. 1–17, 1925.

[6] Harvard University Press, pp. i–xxiv; 1–623, pls. 1–30, 1936.

[7] Report of the U. S. National Museum for 1893, pp. 337–487, pls. 1–19, 70 text figures, 1895.

[8] Annual Report of the U. S. National Museum for 1902, pp. 549–724, pl. 1, figs. 1–197, 1904.

[9] *Bull.* 48, U. S. National Museum, pp. 1–44–1–577, pls. 1–35, 409 text figures, 1907.

[10] Harvard University Press, pp. i–iv, 1–125, 1917; 2d ed., 1923, pp. i–x, 176; 3d ed., 1933, pp. i–xiv; 1–185; 4th ed., 1939, pp. i–xvi; 1–207; 5th ed. In press.

[11] *Smithsonian Misc. Coll.*, Vol. 77, no. 1, pp. 1–21, 1924.

Smithsonian Institution at the one hundredth anniversary of the founding of the Royal Frederic University in Christiania, Norway. In 1912 he represented the U. S. National Museum at the centenary celebration of the founding of the Academy of Natural Sciences, Philadelphia. In 1935 he was a delegate to the sixth International Congress of Entomology at Madrid, Spain. In 1939 he was delegated by the Smithsonian Institution to attend the two hundredth anniversary of the Royal Swedish Academy of Sciences (celebration cancelled) and to attend to official business of the Smithsonian Institution and the U. S. National Museum in Sweden, Norway, Denmark and Finland.

Stejneger was a member of many scientific societies at home and abroad, among which may be mentioned: National Academy of Sciences; American Ornithological Union (fellow); American Society of Ichthyology and Herpetology (vice president, 1915; president, 1919; honorary president, 1937); American Society of Mammalogists; American Association for the Advancement of Science; Washington Academy of Sciences; Biological Society of Washington (president, 1907–08); the Academy of Natural Sciences of Philadelphia; Association of American Geographers; California Academy of Sciences (honorary member); Bergen Museum (life member); Christiania Academy of Sciences; Zoological Society of London (foreign member); Ornithological Society of Bavaria (corresponding member); British Ornithological Union (honorary member); German Ornithological Society; Peiping Natural History, etc. He was a member of the Cosmos Club.

Dr. Stejneger was decorated Knight, 1st class, Royal Norwegian Order of St. Olof in 1906 and Commander in 1939. He was also the recipient of the Walker Grand Prize of the Boston Society of Natural History.

On his eighty-fifth birthday the Smithsonian Institution was presented with a portrait of Dr. Stejneger, painted by Bjorn P. Egeli, purchased by subscriptions made by his associates and friends. On his eighty-sixth birthday Dr. Stejneger was tendered a sumptuous dinner by his associates and friends at the Cosmos Club. Dr. C. G. Abbot, presiding, called upon the following to respond to these toasts: Stejneger, the Youth—His Excellency Wilhelm Munthe Morgenstierne; Stejneger as an Ornithologist—Dr. Alexander Wetmore; Stejneger as a Herpetologist—Professor Albert Hazen Wright; Stejneger as a Zoogeographer—Dr. William Mann; Stejneger as a Nomenclatorist—Dr. Charles Wardell Stiles; Stejneger as a Man—Dr. Albert Kenrick Fisher. These were followed by a response from Dr. Stejneger. On this occasion there was presented to Dr. Stejneger a huge volume of letters expressing felicitations and appreciation written by scientific friends from all corners of the world.

Having been in almost daily contact with Stejneger since 1896, officially and unofficially, I can say that he was an ideal personification of the scientific spirit—a seeker of truth—ever open-minded, without pet theories, whose every study was a problem, the answer the summation of all the counts.

It was interesting to note the change of the man from a rather positive and somewhat aggressive disposition in youth to that of extreme tolerance and patience, particularly with the younger naturalists to whom he was ever willing to lend a helping hand. He was an ideal friend and host and the portals of his house were ever open to his friends from home or abroad. Stejneger was married to Marie Reiners on March 22, 1892, who, with his daughter Inga, survives him.

PAUL BARTSCH

U. S. NATIONAL MUSEUM

DEATHS AND MEMORIALS

DR. FRANK SCHLESINGER, professor emeritus of astronomy of Yale University, from 1920 to 1941 director of the observatory, died on July 10 at the age of seventy-two years.

DR. LESLIE TILLOTSON WEBSTER, member of the Rockefeller Institute for Medical Research, died on July 12 in his forty-ninth year.

DR. WILLIAM JAMES FOSTER, assistant engineer of the alternating current engineering department of the General Electric Company, died on July 2 at the age of seventy-two years. Dr. Foster joined the General Electric Company in 1894 and became an assistant engineer in 1906. He was associated in his work with the late Dr. Charles P. Steinmetz.

BAYARD H. CHRISTY, former president of the Pittsburgh Patent Bar Association, died on June 20 at the age of seventy-one years. He was a life member of the American Ornithologists' Union and the author of numerous papers on birds in ornithological journals.

ARRANGEMENTS have been completed, according to a report in *Chemical and Engineering News,* for the establishment of a foundation in memory of the late Dean Herman Schneider. The Herman Schneider Foundation has been incorporated in Ohio "to encourage the development and advancement of science and education." A building has been purchased and will be ready for occupancy in the fall as headquarters for the engineers and scientists of Cincinnati. There will be an auditorium seating 300, a smaller meeting room for about 100, several committee rooms, a large library, reading rooms, reception rooms, office and recreation space, with possibilities of kitchen and dining-room facilities.

SCIENTIFIC EVENTS

THE BIRTHRATE OF GREAT BRITAIN

COMMENTING on a debate before the British House of Lords opened by Lord De La Warr and participated in by Lord Nathan, Viscount Samuel, Lord Geddes, Viscount Dawson of Penn and the Duke of Devonshire, *The Times*, London, on June 19 writes editorially as follows:

> Lord De La Warr yesterday performed a useful service in the House of Lords by once again drawing attention to the implications of the decline of the birthrate; for the numbers and age composition of the population are, as he said, "the very basis" on which all plans of reconstruction must rest. The significance of present population trends is brought out by a comparison of the position in the 1930's, when there were over 41,000,000 people in England and Wales, with the position in the 1850's, when there were 18,000,000 people. To-day there are just under 10,000,000 women capable of bearing children, compared with only 2,250,000 in 1851. Yet in the ten years 1933–42 390,000 fewer babies were born in England and Wales than in the ten years 1851–60. The reduction of infant mortality since the middle of the last century has greatly improved a baby's chances of survival. Nevertheless there are scarcely more children under fifteen than in the early 1870's, and 2,250,000 fewer children to-day than just before the last war. In fact Britain, in peace as in war, is now living on human capital accumulated in a more fertile past. British mothers and fathers in the twenty years before the last war, although somewhat less fertile than their Victorian ancestors, produced a greater number of children than were born in any period of similar length previously or subsequently. Those children are the young and middle-aged adults of to-day. This generation of potential parents is of record size; and upon them falls the responsibility of bearing and rearing the children of the coming generation. Yet, although they show no aversion from marriage, such is their apparent aversion from parenthood that, if present trends continue, the succeeding generation will fall at least 20 per cent. short in numbers.
>
> At the same time the present generation of potential parents will, in the next thirty years, grow into a generation of old-age pensioners. The proportion of old people over 64 in the total population has doubled itself in the past ninety years; it may well double itself again in the next thirty years. The present generation of adults under 50 is building up for itself far larger claims on the national income for its old age—in the form of pension rights—than any previous generation, and simultaneously it is failing to produce the workers who will have to maintain it in its years of retirement to a far greater extent than any previous generation. In the last analysis the aging of our population—with all that it implies in politics and social life, in economic policy and in imperial and international affairs—is a far more serious issue than the total size of the population. It is the fundamental long-term problem which Britain—in common with all the peoples of Northern and Western Europe—will have to face. Ultimately Britain must have a population policy conducive to social views and social conditions which favor parenthood instead of frustrating it. There can be no question of waiting twenty or thirty years for such a policy. The consequences are certain and action can not be postponed.
>
> Little, however, is yet known about the economics of family life, or about the ways in which, in different income and social groups and in families of different size, parents spend their money on children. Practically nothing is known about current attitudes to parenthood, about the reasons why childbearing is increasingly avoided, or about the whole complex of economic, social and psychological factors which now apparently frustrate parenthood but might be transformed in a cultural and material environment favorable to family life. On all these issues there are many opinions, but a startling lack of factual knowledge. Even although large-scale reforms to encourage parenthood must inevitably wait until victory has been won, there remains an immense task of basic fact-finding investigations, which should be begun without delay. A Royal Commission, suggested by Lord Geddes, may not be the most appropriate instrument for this work. But, however undertaken, there is a strong case for putting it in hand at the earliest moment.

THE BOTANIC GARDEN OF THE UNIVERSITY OF CAMBRIDGE

THE University of Cambridge correspondent of *The Times*, London, gives the following account of the history of the Botanic Garden of the University of Cambridge in connection with the large bequest to the garden received from the estate of Reginald Cory.

After several abortive attempts to found a physic garden in Cambridge University in the sixteenth and seventeenth centuries the first botanic garden was established in 1762, through the generosity of Dr. Walker, then vice-master of Trinity College, on a site five acres in extent now occupied by laboratories on the north side of Downing Street. Until a few years ago one of the trees originally planted, a fine specimen of *Sophora japonica*, still existed there.

Early in the nineteenth century the garden fell into neglect and, being in a confined space in the middle of the town, it became unsuitable for its purpose. In 1831 the university bought 40 acres of land along the Trumpington Road, on the outskirts of the town, for the site of a new botanic garden, which was officially opened in 1846. Great care was taken in laying it out, and owing to its proximity to Hobson's Conduit a large pond stream and bog garden could be established. Interesting trees and shrubs in great variety were planted at an early date; these now beautify the garden and some of them are among the best specimens in the country.

In 1888–91 a new range of glasshouses was erected. These were reconstructed in teak in 1933–34, largely through the generosity of W. J. Courtauld. They now house a fine collection of exotic plants, ranging from succulents to tropical orchids, from palms to tree ferns. In recent years the garden has been fortunate in its curators and superintendents, men of great horticultural skill who have devoted themselves to increasing its beauty and botanical interest. By hybridization they have produced many well-known ornamental plants which are now widely grown, notably the roses *Rosa Cantabridgiensis* and *Rosa Coryana*, gerberas, cinerarias (including "Beauty of Cambridge"), *Columnea Banksii* and *Bomarea Cantabridgiensis*. The garden is an integral part of the university department of botany, and all the botanical staff, as well as the director of the garden, take a great interest in its welfare. It has a deservedly high reputation, and there are now great possibilities of further enhancement.

Many private benefactors have assisted in a most generous way, but there has now begun to accrue the greatest benefaction of all. Reginald Cory, a graduate of Trinity College and a great gardener, took much interest in the garden and handsomely contributed to its funds during his lifetime. When he died in 1934 he bequeathed the residue of his estate to it, with the result that from now onwards it will receive an additional £9,000, rising eventually to £13,000, a year.

In accordance with the terms of the will only £1,000 a year of the benefaction can be devoted to maintenance, the remainder being available for capital expenditure, including the purchase of land for extension. With this very large bequest it should be possible in the course of time to make the Cambridge Botanic Garden one of the best in the world as regards both the variety of plants cultivated in it and general beauty.

With the opportunities now offered, several branches of botany will inevitably be greatly assisted. In the past many important botanical investigations have been carried out at the garden, notably the pioneer researches in plant genetics by the late W. Bateson, Miss E. R. Saunders and Professor R. C. Punnett. From the time of its establishment its facilities have been extensively used by the staff of the department of botany for their investigations.

When, in 1934, the syndicate announced that Mr. Cory had bequeathed the residue of his estate to the university for the benefit of the garden, it was not known that a great sum would result, and it seemed clear that no money was to be expected from this source for many years to come. But the trustees have recently been able to sell certain shares in the family business to advantage, and though at present expenditure on maintenance is inconveniently limited, the university is the recipient of the largest bequest in its history, and Reginald Cory's name will stand high in its list of benefactors.

RECOMMENDATIONS FOR THE CARE OF THE MEDICALLY INDIGENT

A SERIES of recommendations relative to a plan for the medically indigent has been formulated by the Committee on Medical Economics of the Medical Society of the County of New York, and was adopted by the Comitia Minora at its last meeting.

The report of the committee and its recommendations are as follows:

(1) A central municipal registration bureau must be established.

(2) A non-governmental, non-profit agency or corporation is to be set up with the cooperation of the city government, the Board of Directors to consist of one third city officials, one third physicians selected or appointed by the five County Medical Societies of Greater New York, and one third prominent laymen acceptable both to physicians and government representatives. The medical members shall constitute the Medical Policy Committee. There shall be no change in medical policy without the consent of the Medical Policy Committee.

(3) The premium charged shall be approximately such that the physician shall receive \$2.00 per house visit and \$1.00 per office visit. This may be adjusted at the discretion of the Policy Committee.

(4) A panel shall be established and patients in their districts shall consult them. The city shall be zoned in order to prevent physicians from having to travel too far to see these patients and *vice versa*.

(5) All licensed doctors of medicine may register for the panel.

(6) In carrying out the plan, it is apparent that the occasion may arise when it may become necessary to have a specialist's opinion. Fee for this service in the home will be set up with due regard to the costs and solvency of the plan. No physician can be on a panel and at the same time serve as a specialist or special consultant.

(7) Physicians taking care of these patients shall be permitted to have diagnostic tests in the clinics without charge and without the patient becoming a member of the clinic. Some charge is to be made for these tests to prevent too many of them being done.

(8) Medical indigency rates: \$1,000 for single persons; \$1,450 man and wife; \$250 allowance for each dependent (not to exceed \$1,950 per family). This may be

adjusted at the discretion of the Policy Committee. A certificate of registration shall be required for each year.

(9) There shall be a paid physician who shall be chief executive.

(10) The best interest of the patient and the solvency of the plan will consider that the hours for receiving panel calls shall be from 8 A.M. to 8 P.M., except in case of emergency. Calls after these hours shall entail an additional fee at the expense of the patient. The amount of extra compensation to be determined by the Policy Committee.

(11) On due notice, physicians shall have the right to refuse these patients and the patient may change physician if he desires. The physicians involved shall pro-rate the fee.

(12) Since it is recognized that individuals on relief are the responsibility of the city, it is apparent that the plan must be reimbursed for services rendered to individuals on relief if and when the recipient is unable to pay in full or in part for the services rendered.

NEW AND RARE INSTRUMENTS

THE Committee on Location of New and Rare Instruments has the following requests and offers:

Instruments Offered

L. & N. thermionic amplifier
Ammeters—Whitney and Jewel
Various balances
Schmidt & Haensch colorimeter
Platinum calorimeter
Weston D.C. electric meters, voltmeters, ammeters, galvanometers
Spindler and Hoyer electroscope
Two-circle Goniometer (to loan for war use)
Microscopes—Bausch and Lomb centrifuge, Zeiss binocular, Leitz (suitable for photomicrography), Poeller
Optical wedge pyrometer
4 L. & N. portable potentiometers
L. & N. Type K potentiometers
Polarizer and analyzer for microscope
Abbe refractometer
R. Fuess reflectometer
Spectrographs, spectroscopes, spectrophotometers
Saccharimeters
Saybolt Universal Viscosimeter

Instruments Requested

Western Electric electrometer
Flexaform set
Amsler No. 4 integrater
Micromanipulators

Information concerning these offers and requests for rare instruments that can be sold, loaned or leased for essential war research work can be obtained from D. H. Killeffer, chairman of the committee, 60 East 42nd Street, New York 17, N. Y.

THE VIRGINIA ACADEMY OF SCIENCE RESEARCH ENDOWMENT

FOR some years the Virginia Academy of Science has had an endowment fund of about $12,000, which was raised by Dr. J. Shelton Horsley as a research fund when he was president in 1926–27. This fund is administered by a research committee which awards a prize of $50 each year for a meritorious paper read at the meeting, and makes grants in aid of research.

Some months ago, Dr. Gillie A. Larew, of Randolph-Macon Woman's College, who has been a valued member of this committee for some years, was asked to write a short account of its work for the *Alumnae Magazine* of her college. She did so and shortly thereafter was surprised to learn that Mr. and Mrs. C. M. Goethe, of Sacramento, Calif., on reading her account, became so much interested in the work of the committee and its need of greater funds that they generously agreed to offer to contribute $200 a year ($100 each) so long as they conveniently could, provided the academy would raise an additional $400 on similar terms.

At the recent meeting in Richmond, the academy completed the raising of the required $400. Not only were the required pledges obtained, but well over $400 has already been deposited in the bank and checks and cash are in hand that will bring the total to $439. This additional $600 will about double the amount of money available to the committee each year and will make possible some modifications and enlargements of their present policies.

This is directly in line with the policy of the American Association for the Advancement of Science in encouraging research work through its affiliated state academies of science. For several years now it has fostered, encouraged and directed them through the academy conference and has allotted them money for research purposes.

SCIENTIFIC NOTES AND NEWS

THE Marcellus Hartley Public Welfare Medal and Certificate of the National Academy of Sciences was presented on June 14 to John D. Rockefeller, Jr.

THE Society of Chemical Industry has awarded the Chemical Industry Medal for 1943 to Dr. John J. Grebe, director of the Physical Research Laboratory at the Dow Chemical Company, Midland, Mich. The presentation will be made next November.

THE appointment of Dr. Boris Petrovitch Uvarov, of the Imperial Institute of Entomology, as an Hon. Companion of St. Michael and St. George for valuable services in connection with anti-locust measures, is reported in *The Times*, London. Dr. Uvarov has been on the staff of the Imperial Institute of Entomology since 1920 and is at present the technical adviser of the anti-locust campaign which is being carried on throughout North Africa and the Middle East.

Dr. Weston A. Price will be honored by the Cleveland Dental Society with a testimonial dinner on Thursday evening, October 7, at the Hotel Statler in Cleveland. After fifty years of active practice in Cleveland, Dr. Price plans to go to California to continue his investigations on the influence of diet on dental diseases.

Officers for 1943–44 of the American Society of Plant Physiologists have been elected as follows: *President,* B. S. Meyer, of the Ohio State University; *Vice-president,* Paul J. Kramer, of Duke University, and *Secretary-treasurer,* Earl S. Johnston, of the Smithsonian Institution of Washington.

The following officers of the American Rocket Society, 130 West 42nd Street, New York City, have been elected for the coming year: *President,* Cedric Giles; *Vice-president,* Constantine Lent; *Secretary,* J. H. Wyld, and *Treasurer,* Dr. Samuel Lichtenstein.

At the last regular meeting of the Society of Sigma Xi at the University of Oklahoma, Dr. Charles E. Decker was elected president; Dr. Richard L. Huntington, vice-president, and Dr. Leslie Hewes, secretary-treasurer. A celebration of the four-hundredth anniversary of the death of Copernicus was sponsored by the society on June 29.

Honorary professorships at Columbia University have been awarded as follows: Dr. William K. Gregory, who has been on the staff since 1925 and has been associated with the American Museum of Natural History since 1911, has been named DaCosta professor of vertebrate paleontology. Dr. William Duncan Strong, professor of anthropology, has received the title of Loubat professor of American anthropology. Professor Douglas Johnson, since 1937 executive head of the departments of geology and mineralogy, has been given the title of Newberry professor of geology.

Ronald Aylmer Fisher, F.R.S., professor of eugenics at University College, London, has been elected to the Balfour professorship of genetics of the University of Cambridge, the appointment to take effect on October 1.

Dr. T. Shirley Hele, master of Emmanuel College and representative of the University of Cambridge on the General Medical Council, has been elected vice-chancellor of the university for the ensuing academic year.

Vard M. Shepard, who had been temporarily assigned to the Emergency Farm Labor program, has been appointed to the post of extension specialist in animal husbandry at the University of California at Berkeley.

Dr. James A. Adams, formerly assistant professor of zoology at Grinnell College, has been appointed assistant professor in entomology at the New York State Experiment Station at Geneva, N. Y. For the present, he will devote his attention to studies on the biological control of the Japanese beetle.

The appointment is announced of Dr. Reginald C. Sherwood, food chemist of St. Paul, Minn., as assistant chief to Dr. Russell M. Wilder in the civilian food requirements branch of the Food Distribution Administration of the Department of Agriculture in Washington, D. C.

Dr. James M. Schopf has succeeded George M. Sprunk in the microscopical laboratory of the U. S. Bureau of Mines in Pittsburgh. He will continue studies on the origin and constitution of coal varieties that were originally instituted by Reinhardt Thiessen.

Dr. Victor E. Johnson, associate professor of physiology and dean of students in the division of biological sciences of the University of Chicago, on July 1 became secretary of the Council on Medical Education and Hospitals of the American Medical Association. Dr. Basil C. H. Harvey, who retired in September, 1940, after thirty-eight years as a member of the faculty, will return to active duty as acting dean.

Brigadier General James Stevens Simmons, director of the Preventive Medicine Division, Office of the Surgeon General, U. S. Army, was appointed on May 27 by the Board of Overseers of Harvard College a member of the visiting committee for the Harvard School of Public Health.

Sir Lawrence Bragg, Cavendish professor of experimental physics at the University of Cambridge, and Dr. C. G. Douglas, professor of general metabolism at the University of Oxford, have joined the council of the British Gas Research Board.

Dr. Frank Wilcoxon, of the Atlas Powder Company, has become group leader in charge of the Insecticide and Fungicide Laboratory of the Stamford, Conn., Research Laboratory of the American Cyanamid Company.

Dr. L. M. Cline, assistant professor of geology at Iowa State College, has resigned to join the Standard Oil Company of Texas, and Dr. N. E. Fabricius, assistant professor of dairy industry at the college, will join the Golden State Company of San Francisco.

DR. SHERWIN F. WOOD, of La Crescenta, Calif., instructor in the department of life sciences at Los Angeles City College, has recently been commissioned a lieutenant (j.g.) in the U. S. Naval Reserves. He is now in training as a malariologist at the National Naval Medical Center in Bethesda, Md.

DR. REGINALD D. MANWELL, professor of zoology in Syracuse University, has been commissioned First Lieutenant in the Sanitary Corps, and has been assigned to Tilton General Hospital, Fort Dix, N. J., for temporary duty.

RESEARCH projects on quinine and other alkaloids of *Cinchona* are announced as follows: Cornell University Medical College, "The action of Cinchona alkaloids on experimental infections," under the direction of Dr. Harry Gold and Dr. McKeen Cattell; New York University, a threefold investigation on (a) "Quantitative study of intestinal absorption and subsequent distribution of the alkaloids between blood, brain and body fluids," (b) "Mode of action on myoneural systems and micro-organisms" and (c) "Action of the alkaloids on isolated enzyme systems," under the direction of Dr. Dugald Brown; the Johns Hopkins University, "A study of quinine and malaria in the Upper Mississippi Valley," by Dr. Erwin H. Ackerknecht, under Dr. Henry E. Sigerist, of the Institute of the History of Medicine; Battelle Memorial Institute, "A preliminary study of the industrial uses of *Cinchona* alkaloids," under the direction of Dr. M. M. Baldwin and Dr. Frank C. Croxton. All the investigations are sponsored by the Cinchona Products Institute, New York, which also announces the availability of two research fellowships for accredited workers in this field.

THE *Journal* of the American Medical Association states that the National Research Council recently sponsored the visit of a group of investigators to the Nutrition Clinic at the Hillman Hospital, Birmingham, Ala., to study the work of Dr. Tom D. Spies with a view to determining the possibility of extending corn meal to meet special nutritional needs of the South. The visit, it is said, was financed by private contributions and by the Research Council. Among the group were Dr. Russell M. Wilder, Washington, D. C.; Dr. William H. Sebrell, Jr., Bethesda, Md.; Dr. Robert F. Griggs, Elmer M. Nelson and Dr. Frank L. Gunderson, Washington; Dr. Charles G. King and Dr. Robert R. Williams, New York, and Dr. James S. McLester, Birmingham.

A SERIES of lectures on tropical diseases was recently given by Captain Paul W. Wilson, of the Medical Corps of the U. S. Navy, at the Mayo Foundation, Rochester, Minn.

DR. FREDERICK C. LEONARD, chairman of the department of astronomy of the University of California at Los Angeles, on May 26 addressed the student body of George Pepperdine College, Los Angeles, on "Copernicus and the Foundations of Modern Astronomy."

PROFESSOR C. L. METCALF, head of the department of entomology, University of Illinois, has completed a fifteen weeks' series of lectures to the officers at Chanute Field, Rantoul, Ill., on medical entomology and insect control.

IN view of the need for pathologic material in undergraduate and graduate education, the Committee on Pathology of the National Research Council urges that all who have suitable anatomic specimens forward them to the curator of the Army Medical Museum, Washington, D. C., for correlation and distribution to other central agencies and to teaching institutions. Material from the following is particularly wanted: the malarial diseases, bacillary dysentery, endamebiasis, the schistosomiases, filariasis, the trypanosomiases, the relapsing fevers, the leishmaniases, the rickettsial diseases, yellow fever, cholera, plague and yaws. On application to the curator, arrangements for transportation will be made.

THE *Experiment Station Record* reports that the Kansas legislature has appropriated $2,653,000 for the support of Kansas College and four branch stations during the biennium that began on July 1. In addition to lump sum appropriations for salaries and maintenance for instruction and research, the total includes $102,000 for the four branch stations, $52,000 for outlying experimental fields, $10,000 for bindweed experimental work, $30,000 for research work on diseases of livestock, $15,000 for milling and baking research, $20,000 for laboratory equipment, $200,000 for extension work and $60,000 for a 16-week wartime summer session. This total also includes $64,500 for the completion of a military science building, $50,000 for a small animal laboratory building and $12,500 for repairs on the power plant. President F. D. Farrell retired on July 1 to become president emeritus. He will be succeeded by M. S. Eisenhower, associate director of the U. S. Office of War Information.

THE Josiah Macy Jr. Foundation, New York City, has made it possible for the National Committee for Mental Hygiene to distribute a limited number of reproductions or reprints of selected scientific articles bearing on war problems in the field of psychosomatic medicine and psychiatry to medical officers in the armed forces of the United Nations. Those who wish to receive such articles should notify the National

Committee for Mental Hygiene, 1790 Broadway, New York 19, N. Y.

IT is reported in *The Times,* London, that an official mission from the United States has recently arrived in Great Britain to discuss matters of common interest in connection with the control and production of timber and economy in its use. The mission, which was received by the Minister of Production and the Minister of Supply and officials of both Ministries, is visiting the headquarters of the Timber Control at Bristol to open discussions. Visits were also planned to the Home Timber Production Department, to timber control area offices in the provinces and to important centers of production and consumption.

Chemical and Engineering News reports that cinchona tree seeds obtained in the Philippines after the fall of Bataan provide the foundation for development of the quinine industry in the Western Hemisphere. Colonel Arthur F. Fischer, who spent many years in the Philippines raising the cinchona tree, making quinine and fighting malaria, brought 2,000,000 seeds back to the United States after his escape by plane from Mindanao. More than 100,000 seedlings, carefully nurtured by the Department of Agriculture in its experimental greenhouses, are ready for transplanting in Costa Rica. Representatives of Costa Rica and the United States have entered into an agreement under which 10,000 acres of the trees will be planted. A mission soon will leave for Costa Rica to select sites for the large-scale growing program.

DISCUSSION

CONTINENTAL DRIFT AND ANCIENT DUNES

IN 1939, von Huene proposed a method for proving or disproving the Wegener hypothesis.[1] In short, he suggested the fixing of climatic zones "for every possible stratigraphic level in every continent, if possible without gap, in order to see how they coincide." If these were to parallel the climatic zones of to-day they would argue against the drifting continent theory. If, on the other hand, the ancient climates showed an aberrant relationship to modern climatic zones, that would strengthen the Wegener hypothesis.

Von Huene suggests the distribution of gypsum as a criterion for the recognition of climatic zones. Does not the wide latitudinal range in which gypsum forms seriously lessen, if not completely eliminate, its use as such a criterion?

Evidence confined to narrow latitudinal limits is the most suitable. While engaged in field work in some of the eolian Jurassic deposits in the southwestern United States, it occurred to the writer that this type of sedimentary record, properly considered, might supply part of the evidence which, amassed in sufficient amounts, might either strongly support, or seriously question, continental drifting.

Examination of the system of planetary winds for an earth of homogeneous surface shows that under these ideal conditions six distinct wind belts are encountered in the distance between the poles. Of course, the actual wind conditions conform only in a general way to this idealized picture, because geomorphic aspects of the continents, land-sea distribution and ocean currents are not without their effects.

This general conformance of surface winds to the idealized arrangement should be reflected in the dunes formed in the larger deserts and semi-arid areas. The same should be true of ancient dune accumulations with relation to their contemporary wind belts. If the continents have always occupied their present positions and there have been no changes in the positions of the poles, then the direction of movement of ancient winds (as reflected in their deposits) should parallel in a general way the idealized wind direction arrangement. If these ancient winds are found to have blown in directions that largely disagree with the idealized wind direction arrangement as applied to the present positions of the continents, then they should conform in a general way with the earth wind system as applied to the ancient positions of the continents as suggested by Wegener and his supporters.

Cautions must be exercised in studies of this type. Only a general conformance can be looked for, and it is necessary to identify any strata used as definitely of eolian origin.

A limited amount of work has been done, though most of it deals with existing or Recent dune fields. Reiche's classic paper[2] on the Coconino sandstone of northern Arizona (of Permian age) is of a type that would prove very useful in the type of study here suggested. Among American papers dealing with more recent dune deposits, those of Hack[3] and Melton[4] should be mentioned. It is of interest to note that Reiche's and Hack's papers deal with the same general area (northern Arizona). Winds of Coconino (Permian) time blew from a roughly northerly direction. The winds producing the present dunes in this area are blowing from the southwest, and thus conform to the idealized arrangement of winds for a globe of homogeneous surface.

JOHN R. PETERS

EARLHAM COLLEGE

---

[1] Friedrich von Huene, *Am. Jour. Sci.,* 237: 439, 1939.

[2] Parry Reiche, *Jour. Geol.,* 46: 905–932, 1938.

[3] John T. Hack, *Geog. Rev.,* 31: 240–263, 1941.

[4] Frank A. Melton, *Jour. Geol.,* 48: 113–174, 1940.

SOME PALEONTOLOGICAL INFERENCES AS TO THE LIFE-HABITS OF THE AUSTRALOPITHECINES

DURING the last several years the fortunate discoveries of Dr. Robert Broom have thrown considerable light upon the nature of those odd and somewhat humanoid South African primates who first came under scientific attention through the researches of Dr. Raymond Dart. Dr. Broom's finds of adult specimens have served to authenticate completely the original and much debated child fossil *Australopithecus africanus* as well as to establish the existence of more than one type of these apes. Furthermore, they apparently range over a sizable portion of Pleistocene time.

Although intense debate raged over the possible life habits of *Australopithecus africanus,* most of the discussion of the later discoveries has been purely osteological in nature, with the purposes of taxonomy in view. Hence, although Dr. Broom's final monograph has not yet appeared, some tentative suggestions as to what may be inferred in regard to the habits of these curious man-apes seem justifiable. It may serve to clarify, in some degree, the extent to which Dr. Dart's original thesis as to the terrestrial habits of these apes is capable of substantiation.

At the time of the original *africanus* discovery at the Taungs quarry, much was made of the fact that the skull had seemingly been derived from the breccia filling an old passage in the limestone cliff from which the fossil was derived. This was viewed by some as an indication that *Australopithecus,* though not a culture-producing animal, was a cave-dweller and essentially of terrestrial habits. This view has been regarded somewhat dubiously by Sir Arthur Keith[1] and others. It was suggested instead that the fossil might have become embedded along the face of the cliff, which, due to certain discharges from neighboring springs, was growing. Hence, its entombment might have been of an accidental nature. This fact, of course, would militate against acceptance of the idea that *Australopithecus* was necessarily a cave-dweller.

Broom's discovery of the new species, *Paranthropus robustus,* in a mass of breccia which had once formed the floor of a cave at Kromdraai near Sterkfontein, his location, in addition, of *Plesianthropus transvaalensis* in similar cave deposits of Middle Pleistocene age near Krugersdorp must inevitably be regarded as a well-nigh conclusive demonstration of the cave-dwelling propensities of the Australopithecines. We are forced by Dr. Broom's discoveries to contemplate the existence of ground-dwelling apes who, unlike the arboreal or semi-arboreal great apes of to-day, sought refuge among rocks and caverns. One discovery of this nature might be dismissed as accidental. Successive discoveries of similar type imply a more or less habitual use of these sources of refuge.

A number of years ago it was thought in some quarters that when our first human precursors abandoned the refuge of the trees and ventured into the plains only the most formidable, huge and aggressive species would survive the dangers of this open and cursorial existence. Now most certainly some of the human fossils such as *Meganthropus*[1a] do suggest the existence of such forms. On the other hand what do we encounter among the Australopithecines? Apes whose reduced, humanoid dentition would have frightfully handicapped them as fighters and whose size, though by no means inconsiderable, was certainly not gorilloid and which would have been of no great value in fighting off such plains-loving carnivores as the great hunting cats. The anthropoid brain capacity does not suggest that these apes had become effective tool-users, even if for the sake of argument we grant that they were capable of greater instrumental sagacity than their existing arboreal relatives. Yet seemingly they survived over a long period as terrestrial omnivorous hunters whom Dr. Broom, on the basis of certain limb fragments, believes may have been at least mainly bipedal.

The reduced canines and lack of diastemata between the two upper lateral incisors and the canines all testify to a dentition ill adapted to the crushing of tough rinds and fruits. It is a poor fighting equipment as well. Gregory, a number of years ago, expressed the view that "the conditions in which the tips of all the lower teeth are reduced to the same level and the diastemata are closed . . . is connected with . . . obvious changes in habits of feeding and of fighting. . . ."[2] We may well suspect under these circumstances, and particularly in view of Dr. Broom's insistence on the basis of an *os capitatum* referred to *Plesianthropus* that the latter had a human-like opposable thumb, that the Australopithecines had become increasingly skillful in the manipulation of food by the hands. Moreover, the reduced canines would have made the males less formidable antagonists, and it may be at least a reasonable inference that they were perhaps more socially agreeable and less combative than the males of some of the existing great apes.

It is by no means unlikely that, if the Australopithecines had indeed given up an arboreal existence for the ground, they were moving in small hordes or packs.[3] Such animal groups often have a combined power of intimidation and "bluff" which can not be generated by a single individual or family group. Perhaps groupings of this sort, with some faint instrumental inclinations of a dim "eolithic" nature, may successfully have pursued small game and the young of larger mammals. Cliff and cave refuges may have contributed to their survival.

---

[1] "New Discoveries Relating to the Antiquity of Man," pp. 45–46. New York: W. W. Norton & Company, Inc.

[1a] F. Weidenreich, *Far Eastern Quarterly,* Nov., 1942, p. 62, 64.

[2] W. K. Gregory, "Origin and Evolution of the Human Dentition," p. 502. Baltimore, 1922.

[3] A view shared by Broom, *Nature,* 148: 10–14, 1941.

Their odd continuance into times late enough to have brought them in contact with more advanced and truly human forms is by no means their least interesting feature. What curious reactions must have been observable if either group ever encountered the other —the savage first men and these living fossil ancestors of the Pliocene, still apes but more human than any now alive. Was it man himself who swept them out of existence? Probably we shall never know.

LOREN C. EISELEY
THE UNIVERSITY OF KANSAS

"DORMANT" VERSUS "ADVENTITIOUS" BUDS

A RECENT note by Diehl[1] on the sprouting of a staghorn sumac (*Rhus typhina* L.) log begins thus: "Sprouting of adventitious buds in logs or twigs of woody species freshly cut . . ." With no other comment concerning the origin of the sprouts in sumac, the implication is that they, too, are *adventitious*. As the species grows in New York State, however, most and perhaps *all* of the sprouts found on older stems have arisen from dormant buds.

It would seem profitable to restrict use of the term *dormant* or *latent* to buds formed in the axils of leaves (including scales) on the young annual shoots. These buds then persist in a dormant condition for an indefinite time with only sufficient elongation of their steles to keep the buds outside of the enveloping xylem. *Adventitious* buds, by contrast, arise outside of the normal phyllotaxy. It is recognized that adventitious buds, once formed, may also remain dormant, as is true of the root initials in the bark of willow stems. Where the origin is in doubt, or an inclusive term is desired, *epicormic* is advantageous and non-committal.

A considerable amount of unnecessary confusion has arisen from the loose or mistaken usage of the term "adventitious," particularly when the origin of the buds or sprouts in question has not been known. Foresters frequently have been at fault in this respect, but they are not alone. A popular botany text[2] makes the statement "They [adventitious buds] also give rise to the common water sprouts of apple trees and other species," although, as a matter of fact, water sprouts in apple are clearly from dormant buds.[3] Similarly, the stem sprouts of oak[4] and probably most hardwoods of the northeast,[5] as well as pitch pine[6] (*Pinus rigida* Mill.), arise in general from previously existing dormant buds, rather than adventively. In the trunk and branches of apple true adventitious buds do occur rarely in the bark but their usual origin in hardwood stems is from callus masses. A familiar example is the abundance of adventitious shoots from the callus on a cut stump of beech (*Fagus grandifolia* Ehrh.).

This question of terminology is not wholly academic. A large proportion of the northeastern hardwood forest is of sprout origin, and sprouting following thinning or pruning is of concern to both foresters and horticulturists. Reliance on literature requires that terms be specific.

EARL L. STONE, JR.
MARGARET H. STONE
DEPARTMENTS OF FORESTRY AND BOTANY,
CORNELL UNIVERSITY

ACIDITY AND ACTIVITY OF SULFONAMIDES

RECENT work[1] has shown that a definite correlation exists between the bacteriostatic effectiveness and acid ionization constants of sulfonamides. The functional form of this relationship indicates that the drug activity is the resultant of two opposing tendencies, one of which increases effectiveness as the pK increases and the other of which decreases effectiveness. In view of the current opinion that sulfonamide activity is due to the blocking of an enzyme system,[2] it was considered advisable to examine the available data from the point of view of the general concepts of acidity[3] and the law of mass action. Interestingly enough, this fundamentally simple approach leads to qualitative and quantitative predictions which are in good accord with the available facts.

Qualitatively speaking, one would expect the compound of intermediate pK in a group of sulfonamides of widely varying pK to be most effective in producing bacteriostasis, from the following considerations. If the sulfonamide, HD, is a weak acid, then the anion, D^-, may be treated as a base. Similarly, the enzyme, or protein, P, can combine with OH^- and hence may be considered an acid. If P is an acid and D^- is a base, compounds of the type PD^- may be formed. If we assume that the activity of the drug depends on the amount of PD^- that is formed, and recent work[4] indicates that sulfonamide potency is a direct function of its protein-combining capacity, then in a series of drugs of various pK's acting in a solution at pH near 7, for example, those of intermediate pK should be most effective. For if the drug is a very weak acid, the number of D^- ions is very small, even though most of them may combine with the acid P to form PD^-. On the other hand, if the drug is a very strong acid, the number of D^- ions would be quite large in a solution of pH 7, but since D^- is weakly basic, little PD^- would be formed. The maximum PD^- concentration, for equal additions of sulfonamide, would be formed by a drug with some intermediate value of pK.

---

[1] W. W. Diehl, SCIENCE, 96: 2498, 448–9, November 14, 1942.

[2] J. Hill, L. Overholts and H. Popp, "Botany," p. 138. New York, 1936.

[3] V. T. Stoutemeyer, *Iowa Research Bull.*, 220: 308–52, September, 1937.

[4] E. R. Roth and B. Sleeth, *U. S. D. A. Tech. Bull.* No. 684: 4, October, 1939.

[5] M. Büsgen and E. Münch, "The Structure and Life of Forest Trees," pp. 73–74. New York, 1931.

[6] E. L. Stone, Jr., and M. H. Stone, *Am. Jour. Bot.*, 30: No. 4, 1943.

[1] Bell and Roblin, *Jour. Am. Chem. Soc.*, 64: 2905, 1942.

[2] Woods, *Brit. Jour. Exptl. Path.*, 21: 74, 1940; Fildes, *Lancet*, 238: I, 955, 1940.

[3] Lewis, *Jour. Franklin Inst.*, 226: 293, 1938.

The same considerations apply when one considers a basic sulfonamide such as sulfaguanidine, except that in this case the neutral molecule D can combine directly with the acid P to form PD. For basic sulfonamides the same correlation should exist between pK and potency, except that pK now refers to the equilibrium $HD^+ = H^+ + D$.

This qualitative description is supported fully by a detailed, quantitative consideration of the equilibria involved. Complete details of this treatment will be given in a forthcoming publication. For the present it will be sufficient to point out that the equations finally reduce to the following condition relating the pK of the sulfonamide of maximum activity to the pH of the solution:

$$pK_{HD} = pH - \log \frac{1-f}{f} \tag{1}$$

where

$$f = \frac{d \ln K_{PD}}{d \ln K_{HD}}, \tag{2}$$

K_{PD} being the dissociation constant of the enzyme-sulfonamide complex. When f is determined for a given bacterial system, pK_{HD} can be predicted immediately.

Unfortunately we can not make a direct test of this prediction at present, because data for the direct evaluation of f for bacteria are unavailable. Nevertheless, we can evaluate f indirectly for *E. coli* and compare the value so obtained with that derivable from work[4] on the combination of serum albumin with sulfonamides.

Bell and Roblin[1] have found that in a solution of pH 7, maximum bacteriostasis of *E. coli* was obtained with a sulfonamide with a pK of about 6.7. Substituting the appropriate values in (1) we find f is 0.3. Such a value of f is apparently very reasonable if we may compare it with the approximate value derived for serum albumin. From the work of Davis and Wood[4] one can calculate relative values of K_{PD}, for sulfonamides of various K_{HD}'s. A plot of log K_{PD} vs. log (K_{HD}) fits a straight line fairly well and the slope of this line is f. For serum albumin f turns out to be 0.5.

The inhibition of sulfa action by p-aminobenzoic acid is also amenable to the type of treatment described above. In this case we assume that when the ratio of PA^- (the p.a.b.-enzyme combination) to PD^- reaches some fixed value, inhibition sets in. The mass law treatment then predicts that the ratio of the total amount of p-aminobenzoic acid necessary to cause inhibition, to the total amount of sulfonamide present, will be a maximum for the sulfa compound of greatest potency. This is in agreement with the data of Rose and Fox.[5]

Thus, the law of mass action, as applied to a system consisting of a sulfonamide and an enzyme in a buffer solution, predicts the existence and acid dissociation constant of a drug of maximum potency, correlates the effectiveness of basic as well as acid sulfa compounds with their acid ionization constants, and accounts quantitatively for the inhibitory effect of p-aminobenzoic acid.

I. M. KLOTZ

NORTHWESTERN UNIVERSITY
EVANSTON, ILLINOIS

CORRECTION

IN a revision of the proof a serious omission was made in the inadvertent dropping of "and 1 ml. of 0.1% $CuSO_4 \cdot 5H_2O$ solution" after "Aliquots of 2.0 ml are mixed with 6 ml of clear 12.5 per cent Na_2CO_3 solution" on p. 405. Addition of copper is essential in enhancing the sensitivity of the Folin reagent, as already noted by others.

MICHAEL HEIDELBERGER
CATHERINE F. C. MACPHERSON

SCIENTIFIC BOOKS

PHYSIOLOGICAL CHEMISTRY

The Dynamic State of Body Constituents. **By R. SCHOENHEIMER. Harvard University Monograph in Medicine and Public Health No. 3. 79 pp. Harvard University Press. 1942. $1.75.**

THE nineteenth century, which ended about 1914, was the callow age of the physiological chemist. Rudolph Schoenheimer's "The Dynamic State of Body Constituents" marks the transition to a humbler, more realistic and more mature state of mind.

Until recently, the physiological chemist described the animal organism as an engine with a relatively static structure, in which the food was the fuel. A small fraction of the food was used to replace the wear and tear losses of the engine's structure. The working parts of the engine were composed of what was called "protoplasm."

---

[4] Davis, SCIENCE, 95: 78, 1942; Davis and Wood, *Proc. Soc. Exptl. Biol. Med.*, 51: 283, 1942.

[5] Rose and Fox, SCIENCE, 95: 412, 1942.

This concept was typical of the era in which thermodynamics with its satellite Newtonian statistical mechanics reigned as the newly enthroned queen of the physical and chemical sciences. It was the era of combustion engines, the era of Helmholz.

The simplicity of the concept of the organism as a combustion engine was, no doubt, one of its attractions. Another was that it helped the physiologists and physicians who were its devotees to feel respectable in the company of the chemists and especially the physicists who were the rigorous, pukka natural philosophers of the nineteenth century.

The concept of the organism as a machine was not a biological concept at all. The physiological chemist knew, or should have known, better. Bernard had demonstrated that the different forms of carbohydrate are maintained *in vivo* in a dynamic steady state and that so long as the animal is alive this steady state can oscillate between only very narrow boundaries. Bernard amplified and generalized the idea into his great concept—"La fixité du milieu intérieur est la condition de la vie libre." Bernard saw clearly, although he had only few examples, that the constancy of the internal environment was a dynamic steady state, and that its constancy was an essential condition of life and was maintained against the impact of wide variations in the external environment.

Outside his laboratory the physiological chemist got himself befuddled by the siren concept of "protoplasm." He knew it is not a substance at all but a conglomerate of many substances; and the idea told him nothing of functional organization. But nevertheless he accepted "protoplasm" as the structural substance of the living combustion engine; the definitive and essential component of "protoplasm" was, of course, protein. This must have been one of the reasons for the welcome which Folin's theory of protein metabolism (first published in 1905) received, and the tenacity with which it has been retained until very recently in the face of accumulating evidence to the contrary over the last thirty years.

According to Folin's theory, the structural parts of the animal body are subject to a continual but small wear and tear and repair. Since the terms "structural," "mechanical" and "protein" were used almost as if they were synonyms, the sum total of changes involved in this wear and tear and its repair was designated "endogenous" protein metabolism. Because the organism was viewed as an engine, and because the structural substance of an engine wears away only very slowly, it followed that only a small fraction of the protein in the food is needed for "endogenous" metabolism. The remainder of the protein in the food, the bulk of it, is quickly hydrolyzed and burned and the fragments excreted. This moiety was designated "exogenous" protein metabolism. Folin's theory was useful; it was based on data which he was the first to obtain, by methods which he had devised or greatly improved. But these data, it is now proved, were misinterpreted, they were forced into the strait-jacket concept of the organism as a combustion engine.

Fat metabolism was viewed in the same context. The bulk of the fat in the body was a depot of storage material, a reserve of energy. This depot was thought to be nearly inert, drawn on only in time of need. Here also there was conflicting evidence, but for the same reasons as in the case of protein metabolism this evidence was ignored.

Schoenheimer and his colleagues at Columbia obtained direct evidence "that all constituents of living matter, whether functional or structural, of simple or complex constitution, are in a steady state of rapid flux." It should be added that the studies of the Schoenheimer group did not deal with carbohydrate metabolism, to which this generalization also applies. Their findings were summarized by Schoenheimer in his 1941 Dunham lectures, and published in this book. The manuscript was prepared for publication after Schoenheimer's untimely death by Dr. Hans T. Clarke and his colleagues.

All these experiments were "tracer" studies. A substance was "marked" with a stable isotope, deuterium, or N_{15}, or both, fed to an animal, and then, from the concentration of the isotope in different body constituents conclusions could be drawn regarding the chemical changes undergone *in vivo* by the substance into whose structure the isotope in question had been incorporated.

Thus with deuterium as a "tracer," it was shown that the fats of the depots are not inert storage materials but that "the fatty acids of the depot fat are to be regarded as being constantly transported, in the form of fats or phosphatides, to and from the organs, where fatty acids are temporarily liberated by rupture of ester linkages. When fat is absorbed, the acids of dietary origin merge with those from the depot, thereby forming a mixture indistinguishable as to origin. Part of the liberated acids are converted into others, whole new ones are steadily formed by condensation of small molecules derived from other substances. Some of this pool of acids is degraded, and some of it re-enters ester linkages to regenerate fat, which is transported back to the depots. All these complex reactions are so balanced that the total amount and structure of the fat mixture in depot, blood and organs remain constant."

The metabolism of phospholipids deserves a fuller treatment than they are given in this book, especially as we are indebted to isotope studies for nearly all the new and important information on this difficult subject. There is only a cursory sketch of the intensely rapid processes in which the phospholipids are fragmented into their fatty acid, phosphate and choline or ethanolamine components and as rapidly resynthesized.

Essentially the same general picture was obtained of protein metabolism. Here N_{15} was the tracer most commonly used. It was demonstrated that amino acids are continually and rapidly being deaminized and reaminated. Free ammonia is extensively used for reamination. The peptide bonds of the protein chains are similarly continually being broken and reformed. Synthesis of amino acids and protein occurs both when these are abundantly supplied in the diet and when the animal is made to lose weight through inadequate nitrogen in the diet.

It has been argued by die-hard adherents of the older theory that only the so-called "reserve" or "fixed" proteins undergo this rapid disintegration and re-synthesis. Against this argument it was shown that proteins with specific functions, specific antibody proteins, for example, undergo the same rapid synthesis and disintegration as the average immunologically inert serum proteins. Recently it was proved that extensive and rapid resynthesis of protein is continually in progress even in the fasting animal. This and other evidence has destroyed the last vestiges of support of Folin's theory of "endogenous" and "exogenous" protein metabolism.

The important contribution of these studies with isotopes is that they provided direct and incontrovertible evidence for the concept of the organism as a dynamic steady state in which, for the time being at any rate, there is little utility in attempting to distinguish between the chemical changes in the structure of the engine and its fuel. Structural substance and fuel substance are continually interchanging on a large scale and very rapidly.

It is a disservice, however, to the classical pre-isotope methods of physiological chemistry to overlook, as many workers with isotopes and others do, that this concept regarding the proteins in the animal body was enunciated explicitly with a wide variety of supporting evidence before the advent of isotopes.

This criticism applies also to the claims made for the information gained regarding the formation of a variety of amino acids from each other and of urea and creatine. The isotope studies, in most instances, provided only corroborative evidence of facts which had already been firmly established and in more detail by other methods.

In fact, isotope studies have yielded little evidence regarding mechanism. In the two cases they have thrown light on mechanism, the formation of creatine and the transfer of methionine sulfur to form cystine, the same facts were established by direct evidence and in more detail, independently and contemporaneously by non-isotope methods. The latter methods also located the organs in which these changes occur.

The conclusions regarding the dynamic state of body constituents are stated in this book lucidly and eloquently. These ideas are so important that we must regret the book is too short mainly because it is a one-sided account even of the isotope evidence. A broader treatment including earlier non-isotope studies would have shown, on the one hand, more clearly the power of the new tool the physiological chemist has acquired in his use of isotopes and, on the other, the great utility and wide range of the concept of the organism as a dynamic steady state. In contrast to the mechanical nineteenth century concept it has replaced, the new concept is biological. It explains, without strain, the inter-relation between the metabolism of carbohydrate, phosphate and protein, the regeneration of plasma protein, certain aspects of the formation and disappearance of antibodies from the blood, the changing size of organs and muscles in different dietary states. The new concept has given us a view of the organism as a chemical system in which protein, fat, carbohydrate, minerals, vitamins and water are continually and rapidly interacting and yet maintain "la fixité du milieu intérieur" which is "la condition de la vie libre." Our former obscure wonder is replaced by a greater and informed humility and even greater admiration of the marvelous coordination of the complex chemical mechanisms by which living matter sustains itself.

HENRY BORSOOK

CALIFORNIA INSTITUTE OF TECHNOLOGY

MODERN PHYSICS

Introduction to Modern Physics. By F. K. RICHTMYER and E. H. KENNARD. Third edition. xv + 723 pp. 234 figures. New York and London: McGraw-Hill Book Company. 1942. $5.00.

THE late Professor Richtmyer's deservedly popular text on modern physics needs no introduction to the reading public. The progress of modern physics has been so rapid during the fifteen years since the first edition was published, however, that frequent revisions of a book of this character have been necessary in order to keep it up-to-date. Thus a second edition was issued in 1934, and now a thoroughly revised third edition has been prepared by Professor Richtmyer's colleague, Professor Kennard, with the assistance of several of his associates on the Cornell University faculty.

The large amount of new material which had to be included if the text was to live up to its title, raised the difficult question of what to leave out. This matter has been admirably handled by Professor Kennard on the general principle that those topics in classical physics which are adequately treated in available general texts might well be skeletonized to the parts essential for future reference or omitted entirely. Thus the historical introduction has been abbreviated from 77 pages in the first edition to 50 pages, and the chapter on electromagnetism has been confined to those topics which are requisite for the subsequent developments and which are not usually contained in general texts. A short chapter on relativity has been added, but the greater part of the book is devoted to quantum phenomena, their description and their explanation. The chapter on x-rays has been completely revised, that on nuclear phenomena greatly extended, and a new chapter on cosmic-rays has been added.

In spite of these extensive revisions the character of the book has remained true to the standards set by Professor Richtmyer in the original edition. No attempt is made to give a logically complete development of modern theoretical physics. Rather the reader's attention is focussed on the phenomena of modern physics and on the understanding of modern concepts. Simple derivations of theory—often only for special cases—are given, but all complicated analyses are omitted. In this way the reader is led rapidly to the forefront of modern physics without having his attention distracted by mathematical details, which his awakened interest may lead him to fill in at a later time.

The book is designed as a textbook rather than as a treatise or a reference work. The large number of diagrams and photographic reproductions and the excellent printing add greatly to its usefulness. It is safe to predict that this revision will be welcomed with the same enthusiasm which greeted the earlier editions.

LEIGH PAGE

SPECIAL ARTICLES

DEMONSTRATING THE PRESENCE OF SULFONAMIDES IN THE TISSUES[1]

A PREVIOUS communication[2] reported the development of new vehicles (penetrasols) which increased the penetration of a large variety of substances through grossly intact skin (for example, protein allergens, iron, mercury, bismuth and the sulfonamides). One of the methods used to demonstrate the penetration of sulfonamides into and through the skin was excision of the area of inunction and the use of a newly developed histochemical technique, which produces a color reaction with sulfonamide in the tissues. We herewith report the details of this new method, since we believe that it may find many general applications.

I. ANESTHESIA AND EXCISION

Before excising the skin, general ether anesthesia was used in the guinea pigs; and local procain anesthesia in the human subjects. In the latter, the procain solution was injected around and well away from the site of the sulfonamide inunction and eventual biopsy. This is an indispensable precaution, as the presence of injected procain solution, or even fluid alone, could produce erroneous results. The line of excision was made outside and at considerable distance from the site of inunction, in order to avoid displacement of the inunction-material with the scalpel.

II. FIXATION

The usual liquid fixatives can not be employed, as the sulfonamides might be washed out or displaced by the liquid. Dry formaldehyde *gas* was therefore chosen as the fixative. Paraformaldehyde (trioxymethylene) powder is spread over the floors of small glass beakers. These beakers are roofed either with a piece of gauze fixed by a rubber band or by a small glass lattice. The biopsy specimens are spread flatly on these sieves. The small beakers are then placed in a larger glass jar, the floor of which has also been covered with a layer of paraformaldehyde powder. The top of the jar is closed with a well-fitting glass cover. The large jar containing the smaller beakers is kept tightly closed throughout the period of fixation by means of several windings of adhesive tape around the line of closure. (The layer of paraformaldehyde powder on the floor of the small beakers and of the larger jar should be about 1 cc in depth.)

At room temperature, fixation takes place in two to twenty-four hours, depending on the size and thickness of the specimens.

Microtome cutting is best carried out immediately after fixation; but we have, on occasion, obtained good sections as long as ten to fourteen days after fixation, despite some visible shrinkage and discoloration of the gross specimen.

---

[1] This research was made possible by a grant from the Wallace Laboratories, Inc., New Brunswick, N. J.

[2] Herrmann, Sulzberger and Baer, SCIENCE, 96: 451, 1942.

III. CUTTING

Frozen sections of 10 µ to 20 µ (average 16 µ) are cut with care to prevent the microtome knife from displacing the sulfonamide. The specimen should be kept in such a position on the freezing table that the epidermal surface is never directed toward the knife, but always toward the operator. (The tendency of the thin epidermis of animal skin to separate as a thin lamella before the cutting knife can be overcome by placing the specimen sagittally, at an angle of 90 degrees to the edge of the knife.)

IV. CHEMICAL REAGENTS AND PROCESS

After trial of many standard reagents and solutions for demonstrating sulfonamides, we found that for our purposes the most suitable reagent and solution was Ehrlich's reagent, *i.e.*, p-dimethylaminobenzaldehyde, as used by A. E. A. Werner[3] and others for quantitative analyses of sulfonamides in biologic fluids. The optimal reactions were obtained with the following solution:

P-dimethylaminobenzaldehyde	1.0 g (grams)
Absolute alcohol	95.0 cc
Concentrated HCl	5.0 cc

The aldehyde must be as pure as obtainable, with little color or, at most, a light buff shade. Freshly prepared solutions are best, but a solution not over two or three weeks old may suffice, if it has been kept in ground-glass-stoppered, amber-colored flasks.

The frozen sections, obtained in the manner described, are placed directly on a clean slide, by means of a dry camel's-hair brush. Two drops of the above p-dimethylaminobenzaldehyde solution are dropped on the section. After three to five minutes, one to two drops of absolute alcohol containing 5 per cent. concentrated HCl are added. From this point on the procedure must be carried out as quickly as possible. The sections are dried by careful absorption of excess fluid with small pieces of filter paper or before a slowly rotating fan or both. (Warming is not advisable.) When dry, the sections are covered with a high concentration of dammar resin in xylene, as follows:

Dammar resin	10.0 g
Xylene	10.0 g

The cover slip is then superimposed. Air bubbles under the cover slip must be removed; then the edges are sealed with liquid paraffin melting at 56° C.

This method demonstrates the sulfonamide in the tissues as a colored precipitate, ranging from lemon-yellow to orange, depending on the concentration of the drug.

This colored reaction-product bleaches out, particularly rapidly in the presence of air. Even with all precautions to expel air bubbles, with the thick dammar resin employed and with the paraffin sealing of the edges, microscopic examinations and microphotographs should be made as early as posible, and never more than three to four hours after the reaction has occurred.

V. CONTROLS

Several controls are indicated in order to make sure that the yellow to orange color is actually due to a chemical reaction between the sulfonamides and the reagent, and not due to artefacts or to the presence of preformed yellowish or orange material. These controls include:

(1) Examination of sections of tissue which has been exposed to sulfonamide, using all the procedures outlined, with the exception of the treatment with the p-dimethylaminobenzaldehyde solution.

(2) Examination of sections of tissue which has not received sulfonamide inunction and which is known to be free of sulfonamide; or, in the case of systemic administration of the drug, of tissue from the corresponding organ of an individual who has not received the drug. These sections are, of course, to be processed and treated in exactly the same way as the specimen being investigated for presence of sulfonamides, including treatment with the solution of p-dimethylaminobenzaldehyde.

Comparative examination of these control sections and the section being investigated will reveal the presence or absence of (a) preformed colored material and (b) material other than sulfonamide which might give similarly colored reaction-products with p-dimethylaminobenzaldehyde (primary aromatic amines, urobilinogen, urea, etc.).

Our studies indicate that the method just described will be of value in defining the presence, route and localization of sulfonamides in many different tissues (for example, skin, urethra, other mucous membranes, tonsils, bone marrow, etc.); but is not likely to be useful in tissues such as those of the liver, gall bladder, etc. Of course, the localization of the colored material and the intensity of the color can be expected to give only indications of quantity and site, rather than absolute values.

Nevertheless, employing this method in our studies of percutaneous absorption of locally applied sulfonamides in various penetrasol-type vehicles, we have been able to demonstrate that certain of these vehicles favor the concentration of the drug in horny and follicular structures, while others permit penetration and more or less equal distribution through all the cutaneous tissues. Details of these studies on different types of skin-penetrating vehicles, as well as further discussion of the histochemical method itself, will be published shortly.[4]

---

[3] A. E. A. Werner, *Lancet*, 136: 18, 1939.

GEORGE M. MACKEE
FRANZ HERRMANN
RUDOLF L. BAER
MARION B. SULZBERGER

SKIN AND CANCER UNIT,
NEW YORK POST-GRADUATE SCHOOL
AND HOSPITAL,
COLUMBIA UNIVERSITY

ETHER AND METABOLISM IN THE CEREBRAL CORTEX[1]

JOWETT and Quastel[2] have concluded that anesthetic concentrations of ether do not inhibit by more than the experimental error the respiration of the gray matter of the cerebral cortex of the rat or guinea pig. That another metabolic process might be affected by ether was suggested by an observation made on slices of cerebral cortex from cats under ether anesthesia.[3] Measured in phosphate medium, the lactic acid output was greater in slices from these animals than from controls. The present report is concerned with the effect of ether applied *in vitro* on the oxygen uptake and lactic acid output by cat cerebral cortex slices.

The procedure was as follows. First, the oxygen uptake in Ringer-phosphate-glucose medium in six vessels with oxygen in the gas phase, was observed for 45 minutes. Second, a quantity of medium with or without ethyl ether dissolved in concentrations up to 40 mg per cc was added to each vessel through the venting plug by means of a syringe fitted with a long needle, to make a final concentration of up to 9 mg per cc. Third, oxygen uptake was followed for from two to six hours more. The details of the manometric technique were as reported elsewhere[4] except that the shaker speed was 80 cycles per minute. Fourth, metabolism was stopped by tipping in HCl solution from the side arm, and the concentration of ether in the medium was estimated manometrically with a temperature change of 1.5° by the method of Jowett.[5] Fifth, the lactic acid that accumulated in each vessel was determined by the method of Barker and Summerson.[6] In the control vessels the lactic acid content was higher at the end of the experiment than at the end of the first 45 minutes.

Data for 15 cats and the standard errors of the means are given in Table 1, in four groups according to ether concentration. In the first group the concentration was such that it would not produce unconsciousness if present in the blood.[7] In the second group the ether concentration would produce full anesthesia. The higher concentrations would be lethal. Oxygen uptake is recorded as a percentage of the initial rate for each vessel corrected for any change in rate with time in the control vessel, to which an addition of medium without ether had been made. Lactic acid is reported as the difference between the amounts in the vessel containing ether and in the control vessel, divided by the number of hours of exposure to ether.

TABLE 1

EFFECT OF ETHER ON THE OXYGEN UPTAKE AND LACTIC ACID OUTPUT BY SLICES OF CEREBRAL CORTEX OF THE CAT IN RINGER-PHOSPHATE-GLUCOSE MEDIUM

Ether concentration			Oxygen uptake						Extra lactic acid output	
Range	Mean		1st hour		2nd hour		3rd hour			
$\frac{mg}{cc}$	$\frac{mg}{cc}$	M × 1000	$\frac{c.^*}{o.}$	Per cent. of control	$\frac{c.^*}{o.}$	Per cent. of control	$\frac{c.^*}{o.}$	Per cent. of control	$\frac{c.^*}{o.}$	mg/g/hr
0.025–0.4	0.2	2.7	$\frac{6}{14}$	97 ± 1.85	$\frac{6}{14}$	95 ± 2.09	$\frac{3}{3}$	90 ± 6.46	$\frac{6}{14}$	4 ± 0.93
0.7 –1.6	1.3	17.5	$\frac{9}{15}$	100 ± 1.34	$\frac{9}{15}$	101 ± 1.29	$\frac{5}{11}$	100 ± 2.00	$\frac{9}{15}$	3 ± 1.19
2.0 –5.3	3.7	50	$\frac{7}{14}$	103 ± 1.73	$\frac{7}{14}$	106 ± 1.89	$\frac{5}{8}$	111 ± 3.63	$\frac{7}{14}$	5 ± 0.62
6.7 –9.6	8.4	113	$\frac{6}{9}$	107 ± 6.1	$\frac{6}{9}$	86 ± 8.8	$\frac{6}{9}$	43 ± 6.9	$\frac{6}{9}$	14 ± 2.75

* Number of cats/number of vessels.

---

[4] MacKee, Herrmann, Baer and Sulzberger, *Jour. Clin. and Lab. Med.*, 1943 (in press).

[1] Aided by a grant from the Milton Fund of Harvard University to Henry K. Beecher.

[2] M. Jowett and J. H. Quastel, *Biochem. Jour.*, 31: 1101, 1937.

[3] H. K. Beecher and F. N. Craig, *Jour. Biol. Chem.*, 148: 383, 1943.

[4] F. N. Craig and H. K. Beecher, *Jour. Neurophysiol.*, 6: 135, 1943.

[5] M. Jowett, *Biochem. Jour.*, 31: 1097, 1937.

[6] S. B. Barker and W. H. Summerson, *Jour. Biol. Chem.*, 138: 535, 1941.

[7] H. W. Haggard, *Jour. Biol. Chem.*, 59: 753, 1924.

The observation that ether in sub-lethal concentrations had no effect on oxygen uptake confirms the results of Jowett and Quastel. With regard to the hypothesis that ether acts as an anesthetic agent because of an inhibitory influence on oxidations in the central nervous system, the evidence from the rat, guinea pig and cat is considered strongly negative.

With even the lowest concentrations of ether there was a small but significant increase in lactic acid output. This appeared to be a unitary phenomenon, for, as the concentration of ether was raised, the extra lactic acid did not change appreciably until a definite inhibition of oxygen uptake occurred. The increase in lactic acid output by low concentrations of ether was small compared with that produced by cation imbalance[8, 9] and by various dyes.[10] Since it appears with concentrations found in blood during light as well as deep anesthesia, the effect may be of interest in theoretical considerations of the mechanism of action of ether in anesthesia.

FRANCIS N. CRAIG[11]

ANESTHESIA LABORATORY OF THE
HARVARD MEDICAL SCHOOL,
MASSACHUSETTS GENERAL HOSPITAL,
BOSTON, MASS.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

LARGE-SCALE PRODUCTION OF PENICILLIN[1]

LARGE-SCALE production of penicillin is hampered by the necessity of: (1) providing a surface area exposed to the air of approximately 500 sq cm per liter of culture medium and of (2) growing the organism, *Penicillium notatum*, for 5 to 8 days under such conditions. Consequently, the production of large quantities of penicillin requires the use of a large number of culture vessels over a period of time. The idea occurred to the author that the fungus might grow well and produce penicillin continuously in a constant flow of medium trickling over a column of wood shavings in a setup similar to that commonly employed in the "quick" or "generator" process for the production of vinegar from wine or cider by the acetic acid bacteria. In the acetic acid generators a relatively large surface area per unit of volume is exposed to freely circulating air and medium with the result that the acid is produced rapidly and in quantity. The following experiments were designed on a laboratory scale to determine the feasibility of producing penicillin under conditions similar to those prevailing in vinegar generators.

The experimental apparatus consists of a glass tube 4 feet long and 2 inches in diameter containing a 3-foot column of wood shavings supported on a 4-inch layer of larger pieces of wood. In the original apparatus a stream of air was circulated upward through the column, but as the shavings were rather fine, the organism tended in time to block the upward passage of air as well as the downward flow of medium. It was found, however, that this can be prevented by the use of large shavings and a looser packing of the column. A downward flow of air also proved satisfactory.

In the present arrangement, the top of the tube is closed with a two-holed rubber stopper carrying: (1) a glass tube for the entrance of air filtered through a column of sterilized cotton and (2) a thick-walled capillary tube drawn out to a fine point for the delivery of the culture medium. From a large flask supported above the column, the fresh medium flows through a siphon connected to the capillary tube, which delivers it drop by drop on top of the column of wood shavings. The rate of flow is controlled by the diameter of the capillary tip and also by a pinchcock on the rubber tubing connecting the capillary tube to the reservoir of medium. The bottom of the glass column is closed with a one-holed rubber stopper fitted with a glass exit tube which allows the escape of air as well as of medium. This exit tube is connected by means of a piece of rubber tubing to a collecting flask equipped with a two-holed rubber stopper through which passes: (1) a tube for the liquid and air to enter the flask and (2) an air exit tube connected to the suction line. Medium, rubber tubing and collecting flasks are sterilized in the autoclave and fitted aseptically to the appropriate tubes of the culture apparatus. The latter, packed with wood shavings and with stoppers in place, is sterilized by allowing steam to flow through it for two hours.

Three culture columns as described above are now in operation. One of these columns consists of two such tubes in series and is used to determine the effect of doubling the length of the culture column. All studies were carried out in a 26° C. constant temperature room.

After the columns are sterilized and the medium reservoir and collecting vessels attached thereto, the shavings are well wetted with culture medium and

---

[8] C. A. Ashford and K. C. Dixon, *Biochem. Jour.*, 29: 157, 1935.

[9] F. Dickens and G. D. Greville, *Biochem. Jour.*, 29: 1468, 1935.

[10] F. Dickens, *Biochem. Jour.*, 30: 1233, 1936.

[11] Present address, Department of Physiology, New York University College of Medicine.

[1] Aided in part by the Fluid Research Fund, Stanford University School of Medicine.

inoculated with a spore suspension of *P. notatum*.[2] Czapek-Dox medium (Florey et al.[3]) containing 4 per cent. glucose and 0.1 per cent. Difco yeast extract was employed. A continuous flow of the medium is started 24 hours after the inoculation and growth of the fungus usually becomes well established by the 5th day. In one of the columns the medium was allowed to collect and was drained off daily instead of continuously. In this case there was a marked inhibition of growth, even with vigorous aeration. This column was, therefore, converted after several days to continuous flow arrangement. Ordinary surface cultures of *P. notatum* in the same medium served as controls for comparative purposes on the amount of penicillin produced.

The rate of flow of medium has been varied from 400 to 1,000 ml daily and the sugar content from 1 to 4 per cent. with little influence on penicillin titer. After growth is well established, yeast extract does not appear to be essential for penicillin production, but a 4 per cent. concentration of sugar may be of some value inasmuch as all but a fraction of a mgm of sugar per ml is utilized during the flow of the medium through the growth column.

One column has been in satisfactory operation and free from bacterial contamination for 15 days. The rate of flow of the medium through this column has varied from 600 to 800 ml daily and the effluent has had a pH of 7.0–7.3. Serial dilutions in broth of the penicillin-containing effluent were inoculated with *Staphylococcus aureus*. Growth in the various dilutions following 20 hours incubation at 37° C. was compared with that of a control culture of *S. aureus* and with serial dilutions tests on ordinary surface cultures of *P. notatum*. Typical results are presented in Table 1.

TABLE 1

PENICILLIN TITER IN CONSTANT FLOW AND ORDINARY CULTURES OF PENICILLIUM NOTATUM

Fluid from	Age of culture in days	Dilutions				
		1–10	1–20	1–40	1–80	1–160
Constant flow apparatus	5	–	–	–	‡	+
	10	–	–	–	–	+
	15	–	–	–	‡	+
Ordinary culture, maximum titer	6	–	–	–	–	+

– no growth, ‡ slight growth, + full growth of *S. aureus*.

It is apparent that the penicillin titer of the effluent from the constant flow apparatus approaches that observed with the fluid from ordinary surface cultures of *P. notatum*. Only one strain of *P. notatum* and one medium has been thoroughly tested thus far. Higher titers might well be obtained with other strains of the fungus or in other media. In incomplete studies the substitution of corn steep liquor in place of yeast extract more than doubled the amounts of penicillin produced. The constant flow method appears to have the advantage that once growth of the organism is well established, penicillin is produced continuously and a large volume of penicillin-containing liquid can be obtained with a minimum of equipment in a short period of time.

Doubling the length of column by connecting two tubes in series appears to increase the penicillin concentration in the effluent to a slight extent. Some difficulty was experienced in obtaining satisfactory growth in the second column due to the rapid depletion of the culture medium. Therefore, the influence of an increased rate of flow of a more concentrated medium was tested, but bacterial contamination was encountered before entirely conclusive results could be obtained.

Further studies on factors influencing the production of penicillin in a flow of medium continuously trickling in a thin stream over the fungus growing on a column of shavings are in progress. The prevention of bacterial contamination appears to be the most difficult, but not insurmountable, obstacle to the production of penicillin on a large scale. The apparatus employed in this study may also prove satisfactory for the growth of other aerobic organisms producing antibiotic agents. The results of these preliminary studies suggest that a fairly high penicillin titer can be obtained under the conditions described and that penicillin may be produced rapidly and in large quantities in acetic acid generators.

C. E. CLIFTON

DEPARTMENT OF BACTERIOLOGY,
STANFORD UNIVERSITY

---

[2] The culture of *P. notatum*, from the original Fleming strain, was provided through the courtesy of the Cutter Laboratories, Berkeley, Calif.

[3] E. P. Abraham, E. Chain, C. M. Fletcher, H. D. Gardner, N. G. Wheatley, M. A. Jennings and H. W. Florey, *Lancet*, 241: 177–88, 1941.

BOOKS RECEIVED

Essays in Biology. In Honor of Herbert M. Evans. Illustrated. Pp. xxxi + 684. University of California Press. $10.00.

DUBLIN, LOUIS I. *A Family of Thirty Million.* Illustrated. Pp. xvi + 496. Metropolitan Life Insurance Company.

LUCK, JAMES MURRAY. *Annual Review of Biochemistry.* Illustrated. Pp. ix + 704. Annual Reviews, Inc. $5.00.

MURRAY, RAYMOND W. *Man's Unknown Ancestors.* Illustrated. Pp. xiii + 384. The Bruce Publishing Company. $3.50.

RAVEN, C. E. *Science, Religion, and the Future.* Pp. x + 125. The Macmillan Company. $2.00.

SMITH, H. T. U. *Aerial Photographs and Their Applications.* Illustrated. Pp. xiv + 372. D. Appleton-Century. $3.75.

WHITE, MARSH W. *Practical Physics.* Illustrated. Pp. x + 365. McGraw-Hill. $2.50.

SCIENCE

Vol. 98 FRIDAY, JULY 23, 1943 No. 2534

Organization of American Scientists for the War: Dr. Karl T. Compton 71

Obituary: *Henry Seely White:* Professor Mary Evelyn Wells. *Arthur Trautwein Henrici:* Dr. W. P. Larson. *Recent Deaths* 76

Scientific Events: *Research in the United States; Vitamin D Patents; The National Metal Congress; The New Director of the U. S. Geological Survey* 78

Scientific Notes and News 80

Discussion: *Cirques, Hanging Valleys and High-level Benches in Glacier National Park:* Dr. Wm. C. Alden. *Grazing Versus Maple Syrup:* Professor Paul B. Sears. *The Merits of Abstracting Journals:* Professor Harold Kirby 82

Quotations: *Science and Society* 84

Scientific Books: *The World of the Physicist:* Professor Gordon Ferrie Hull. *Radiology in Industry:* Dr. S. Reid Warren, Jr. *Enzymes:* Dr. Frederick Bernheim. *Wildlife Refuges:* Professor C. E. McClung 85

Special Articles: *Interference on Inactive Virus with the Propagation of Virus of Influenza:* Dr. Werner Henle and Dr. Gertrude Henle. *The Effect of Castration and Testosterone Propionate on d-Amino Acid Oxidase Activity in the Mouse:* L. C. Clark, Jr., Dr. Charles Kochakian and R. Phyllis Fox. *Differential Inhibition between Normal and Tumor (Crown Gall) Tissue in Beet Roots:* Dr. Moritz Michaelis, Dr. Irving Levi and Professor Harold Hibbert 87

Scientific Apparatus and Laboratory Methods: *A Sensitive Color Reaction for the Detection of Uracil and Cytosine:* Professor Treat B. Johnson. *A Nylon Blood and Plasma Filter:* Dr. S. Brandt Rose 90

Science News 8

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell; Ware Cattell, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

ORGANIZATION OF AMERICAN SCIENTISTS FOR THE WAR[1]

By Dr. KARL T. COMPTON

PRESIDENT, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Introduction

In ordinary times any American scientist would deem it a distinguished honor to be nominated as the Pilgrim Trust lecturer. In these extraordinary times the significance of this lectureship is enhanced by the fact that American and British scientists are working hand in hand, not only to advance science as an important aspect of man's culture, but now especially as a powerful tool for the preservation of our opportunities for continued life, liberty and pursuit of happiness. Consequently, when Sir Henry Tizard transmitted your invitation for me to deliver this lecture I accepted the invitation with profound appreciation and humility.

There were also two personal aspects of this invitation which aroused in me a sentimental reaction. The establishment of the Pilgrim Trust lectures was announced to the Royal Society by your late colleague, Sir William Bragg, in his presidential address at the anniversary meeting of the society in 1937. Not only has Sir William Bragg, together with his distinguished son, been an inspiration to my generation of American physicists, but it happens that he delivered the address at the graduation exercises of the Massachusetts Institute of Technology on the occasion of my inauguration as president of that institution in 1930. I recall very vividly his remarks on that occasion and my feeling that his presence was an inspiration to me at that time when, with considerable trepidation and regret I moved from the research laboratory into an administrative office.

In that address Sir William traced the development of modern institutions for technical instruction and drew his illustrations from the lives and work of

---

[1] Pilgrim Trust Lecture, under the auspices of the Royal Society of London, London, May 20, 1943.

Count Rumford, Thomas Bernard and Michael Faraday. Permit me to read several excerpts from Sir William's address.

> A school of technology is an expression of the wish to gather together the growing knowledge of nature, of natural materials and laws, and to make that knowledge of service to mankind. . . . Where and when did this movement begin?
>
> It is not of great antiquity. Perhaps the seventeenth century includes its first recognizable appearance, marked by the new-found delight in careful experimental examination of the world. The Royal Society of London was founded in the troubled times of conflict between King and Parliament: where we read the account of the early proceedings of the society we are reminded of boys let out of school, running quickly to brook and hedgerow to examine the extraordinarily interesting things to be found there at every turn. A very important account of the methods of ventilating mines in Belgium comes next to the careful description of some animal monstrosity such as a calf with more than the proper allowance of heads or legs. The professor of astronomy at Oxford writes on the use of incubators in Egypt. Early discussions on tide prediction, then a very important matter because the old harbors did not easily accommodate the large boats wanted for the American trade, lie side by side with a disquisition on a remarkable set of teeth and pertinent references to the properties of sugar. The hodge-podge is readily understandable. The infant was beginning to notice and ask questions. . . . We can well be amused at all this, remembering that the infant has now become a very sturdy youth: and that the proceedings of these early fellows of the Royal Society were only the first results of the new regard for natural knowledge.

Sir William then proceeded in most interesting fashion to sketch the significant facts in the life, work and social viewpoint of Count Rumford and Thomas Bernard, and pointed out that the wealth of Bernard and the stimulation given by Benjamin Thompson, both of them men who spent their early lives within a few miles of my home in Massachusetts, led to the establishment of your Royal Institution.

Then, after drawing lessons from the life of Michael Faraday, Sir William concluded with these words.

> Science was not merely a collection of inventions to be applied by the rich for the comfort of the poor. It was a glorious purpose to be shared by all mankind. We must try to understand the world in which we live, for our own enjoyment, for the training of our minds, for the enrichment of our souls' contemplation, for the means whereby we may help each other.
>
> It is in this spirit that we may try to do our work. It is true of course that we must work for ourselves; instructors have to earn their living and students must come to learn how to earn theirs. As the world is made it must be so, but also the world is so made that the vision of its wonder and of the delight of mutual service and the happy task of exploring the one to help us in achieving the other, can light our lives for us as the sunshine lights the earth.

As we think of the noble ideals which Count Rumford, Thomas Bernard and Michael Faraday held for science as that which "can light our lives for us as the sunshine lights the earth," it is a grim and discouraging contrast to see the scientists of the world engaged to-day in developing new instrumentalities for destruction or other instrumentalities for protection against the destruction which would be wrought upon us by the engines of war of our enemies. The fact that this is so is a grim reminder that our skill in statemanship and our art and ethics of Christian living have not kept pace with our ideals. We have no alternative now but to apply our knowledge of science in every aspect to serve us in our struggle for survival and to preserve for us that opportunity for which our race has struggled throughout the centuries—the opportunity to live and work in peace and freedom.

As the second personal note, let me lay claim to scientific kinship with your body as one who might be called a scientific grandchild of another one of your late leaders, Sir Joseph Thomson. We in America affectionately called him "J.J.," as I understand you also did in England, and we look upon him as the progenitor of that tribe of physicists who interested themselves in the conduction of electricity through gases. Taking him as the founder of that tribe, one of the second generation, your Sir Owen Richardson, was my guide and inspiration during my graduate student years at Princeton University. For his sake I am sorry that I did not turn out to be a more productive pupil, but the interests and satisfactions I have had in the field of research I owe more to him than to any other man.

As you know, we in America have two principal scientific societies which are broadly representative of all the fields of science and which are rather parallel to two of your principal scientific bodies, the Royal Society of London and the British Association for Advancement of Science.

Dr. Frank B. Jewett, president of our National Academy of Sciences, has asked me to deliver his personal message to the president of the Royal Society of London, Sir Henry Dale, and in addition he requested me to express to you the admiration which is felt by the members of the National Academy of Sciences for the magnificent manner in which the scientists of Great Britain have thrown the whole weight of their energies and abilities to master the innumerable technical problems arising in this war. He wanted me to assure you that in so far as we can do likewise, we in America are making a sincere effort to handle our similar problems and cooperatively to supplement the great work which you are doing.

Dr. Isaiah Bowman, last month elected president of the American Association for the Advancement of Science, also gave me a message of greeting to British scientists from which I quote as follows:

> Now that the war has advanced to the stage at which we begin to talk of post-war plans, we feel more than ever the need for collaboration between Great Britain and the United States. While there is no such thing as an Anglo-American bloc in world politics there is such a thing as close comradeship in the fight for principles. This comradeship we feel whenever we deal with the leaders of Britain and whatever the field of interest.
>
> I venture to predict that, whatever difficulties may arise, we shall find that comradeship and agreement upon principles will ever mark our future relations. This belief is based upon our widely recognized common responsibility for the peace and safety of mankind in the years after the war. If England is being changed by the war the United States is changing just as rapidly. Once our President was able to report on "the state of the Union," as our Constitution provides, almost without touching on foreign affairs. Two world wars have changed both the tenor and the scope of such messages. The state of the Union now includes the state of the world.
>
> This conception of the state of the Union lays new obligations upon us all. The scientist can no longer report on the state of the sciences. He must report on the impact of science upon society. He must make use of the qualities of mind that science fosters in dealing rationally with the terrible waste in vital resources that war imposes upon the human species. We may hope that the day will soon come when every mature man and woman will feel himself responsible for the state of the Union and act responsibly in that sector of our common life committed to his care, no matter how small the sector may be, no matter how humble.
>
> We say these things while recalling again how great an inheritance they represent from the unfolding political life of Great Britain. No one can speak of liberty and political responsibility and community enterprise without echoing truths that were discovered by centuries of experiment and experience on the part of rulers and ruled in the English political system. Thus, no matter where one starts in estimating future problems and future responsibilities, one ends by recognizing the special bond between America and Britain, by acknowledging the rich inheritance that has been responsible for so many strong elements in American life, and by elevating the comradeship that we both feel and need.

And now I come to the subject of my address. I have chosen to speak on a subject pertinent to the war, to describe to you the manner in which American scientists have organized to make their contribution to the same cause which has mobilized your efforts. In so doing, I trust that I shall be within the spirit, if not the letter, of Sir William's directive for these lectures. For he said, "Such lectures would associate workers in a common task," and surely our common task right now is to direct our scientific resources for victory.

In these days, when numbers of scientists are crossing the Atlantic in both directions on special missions, a better understanding of each other's organizations may be practically helpful. For I frankly confess sympathy with one of your number who recently told me that he found the American organization of interrelated scientific groups a bit complicated. I can only draw cold comfort from the fact that, complicated as it is, the scientific organization is far simpler than that of our governmental departments and bureaus generally. But that is another story.

PEACE-TIME ORGANIZATION OF SCIENTISTS IN THE UNITED STATES

Let me first give an over-all picture of the scientific and technical organizations of the United States as they exist in peace-time. After this brief review I shall pass to a discussion of the special scientific organizations for war, which is the subject of more particular interest to us at this time.

The scientific and engineering work in the United States may be discussed under three categories: first, the agencies of the Federal Government, exclusive of the Armed Services; second, the agencies within the Armed Services; and third, the non-governmental agencies.

Federal Bureaus. The scientific services of the Federal Government in peace-time are spread through about 40 federal bureaus, of which 18 can be called primarily scientific. Their operations involve only about half of one per cent. of the total peace-time federal budget, but their work is of course absolutely essential to the national welfare in agriculture, manufacture, commerce, health and safety. The personnel of all these bureaus operates under the Civil Service.

From point of view of size of personnel and budget, the scientific services under the Department of Agriculture stand first in the list. Probably these scientific establishments, however, are not as well known generally as those of some of the other departments because their research work is quite largely spread through a great number of agricultural experimental stations distributed throughout the various states of the union and operated cooperatively between the Federal Government and the States. Most of the bureaus in Washington are primarily of an administrative character, but there are several which also conduct centralized research, as, for example, the Bureau of Chemistry and Soils and the Food and Drug Administration. Until recently the U. S. Weather Bureau operated under the Department of Agriculture, but a few years ago it was transferred to the Department of Commerce, largely because the requirements of air transportation had taken the lead in demanding more accurate and refined methods of weather forecasting than those which had served reasonably well in the past to provide for the needs of agriculture.

Many of you will probably recognize some of the more important of these governmental scientific bureaus, as, for example, the National Bureau of Standards under the Department of Commerce, the Geological Survey, the Bureau of Mines and the Bureau of Mineral Statistics and Economics under the Department of the Interior, and the National Institute of Health under the U. S. Public Health Service.

Of particular interest because of its unique character is the National Advisory Committee for Aeronautics, which was established during the last war and which operates three great research establishments. Until recently the work of the NACA was centered in the aerodynamical research program at Langley Field, Virginia. Several years ago there was added another aerodynamical research establishment named the "Ames Laboratory" at Moffett Field, in California, and quite recently still another large research and development establishment for aircraft engines in Cleveland, Ohio. Also, under the NACA, there are currently some 80 research projects being carried on at universities under contract. This obviates unnecessary duplication of facilities in a government laboratory and maintains a group of university scientists and engineers in close contact with the problems of aeronautical research.

The administration of this organization is also unique among our federal scientific agencies in that its controlling body is a committee which serves without salary and has been composed of men of such high character and distinction as to render it completely free from political influence. This committee is provided with representation from the most interested branches of the Army, Navy and governmental departments, but the chairman and the majority control reside in a body of citizen scientists appointed by the President who, in practice, has followed the recommendations of the chairman in appointments to fill vacancies. The present chairman of the NACA is Professor J. C. Hunsaker, head of the departments of mechanical and aeronautical engineering at the Massachusetts Institute of Technology, and incidentally, while a very young man, the designer of the first American airplane to fly the Atlantic.

Turning now to the United States Armed Services, I can best describe their research and development work as principally a cooperative effort between the services themselves and American industrial companies, with occasional participation from the research laboratories of the technological and educational institutions.

Army. Each branch of the Army contains a technical division under which operate laboratories or arsenals in which a certain amount of research and development work is carried on but whose activities consist for the most part of testing and proving new war materials or equipment. Thus the technical staffs in the various branches of the Army and Navy have the threefold duty of planning and coordinating an extensive program of research and development carried on in the industrial laboratories, of organizing and conducting research programs in their own establishments, and of carrying on the extensive operations of proving and testing which result in the acceptance of new devices and the drafting of specifications for production orders.

Among the principal Army establishments in which such work is centered, I would mention particularly those falling under the Ordnance Department, the Signal Corps, the Chemical Warfare Service and the Army Air Forces. The Ordnance Department operates a great proving ground at Aberdeen, at which is centered most of the proving and testing of ordnance and research on ballistics for arms of all types. In addition it operates five principal arsenals. The Watertown Arsenal is concerned principally with the manufacture of mounts for large caliber guns and is the principal center for research and technical service in the field of metallurgy. The Picatinny Arsenal is devoted to the testing of explosives and the design and operation of pilot plants as guides to the industrial producers. The Rock Island Arsenal carries on research and development in the field of oils and lubricants. The Frankford Arsenal supplements the Aberdeen Proving Ground as a testing and a development center for small arms. The Tank Arsenal in Detroit is the center for the design and testing of tanks.

In the Signal Corps the technical division is divided into three principal branches: the Ground Signal Branch, the Electronics Branch and the Aircraft Radio Branch. The research, development and testing work carried on under the Signal Corps is divided principally between the signal laboratories at Fort Monmouth, Camp Evans, Camp Coles, Eatontown and Toms River. The Signal Corps also maintains a large cooperative establishment working with the Army Air Forces at its principal center, Wright Field.

Until quite recently the research and development work of the Chemical Warfare Service was centered in its great Edgewood Arsenal. As the threat of war came closer, however, a few years ago, and since a very large portion of the facilities at the Edgewood Arsenal are taken up by production, the Chemical Warfare Service established a subsidiary research laboratory and took over for this purpose the newly erected Chemical Engineering Laboratory of the Massachusetts Institute of Technology.

Despite the great expansion of the Army Air Forces, this service has continued to concentrate its research, development and testing activities at its huge establishment at Wright Field in Ohio. There are of course many other centers at which extended service testing goes on, or at which new equipment is installed in aircraft, but Wright Field remains the headquarters for the research and development work of the Army Air Forces.

The coordination among all these various technical services of the Army is maintained by two types of agency. Within each branch of the Army is a board which has general supervision over technical matters within that branch. Examples are the Coast Artillery Board and the Army Engineers Board. When a project has been approved by one of these boards it is next passed upon by the appropriate Technical Committee, composed of members of this branch of the service, and other branches which may be concerned with the project. If this technical committee also approves the project it goes as a recommendation to the general staff which presumably issues the appropriate directive.

Mention should be made also of the Army Medical Corps, within which a significant amount of research is conducted under the general supervision of the Surgeon General of the Army.

Navy. The Naval Observatory and the Hydrographic Office, which are under the Chief of Naval Operations, have obvious functions in research and development work. The Marine Corps does some research, but naturally depends to a large extent on the Army and the various Bureaus of the Navy. All the Bureaus of the Navy Department, Ships, Ordnance, Aeronautics, Naval Personnel, Supplies and Accounts, Medicine and Surgery, Yards and Docks, do research and development work, though naturally the materiel bureaus conduct the greatest volume.

All research work of the Navy Department is tied together through the office of the Coordinator of Research and Development, which office also arranges coordination with the Army, with other government departments and with the numerous civilian agencies which I will mention later.

Under the Bureau of Ships the Naval Research Laboratory near Washington is a center for all matters of fundamental research, including radio, electronics, chemical warfare defense, etc. The David W. Taylor Model Basin, also near Washington, is the primary station for research and development of ship structures, propeller and hull design. The Naval Boiler and Turbine Laboratory at Philadelphia is concerned with all matters of boiler research, testing and design, including fuel, composition, quality and nature of boiler fuels, ceramics, etc., and also for research, test and development of main propulsion turbines. The U. S. Naval Engineering Experiment Station at Annapolis, Md., is assigned all problems of research, test and development of mechanical equipment in ships other than main propulsion, and it also has a well-equipped Diesel engine laboratory. The principal metallurgical laboratory for the Bureau of Ships is also located at the Engineering Experiment Station. In New York there is located the Materials Test Laboratory, which handles all matters of research, test and development of electrical materials and equipment, acoustical equipment, optical and navigational material and equipment, plastics and allied materials. There are rubber and paint laboratories at Mare Island, California, and an inspection test laboratory in Pittsburgh, Pa., where line production methods for chemical analyses are set up which permit a capacity of about 5,000 chemical analyses per week with a minimum of personnel and equipment. In addition to the above each Navy Yard is equipped with an industrial laboratory to serve the purposes of the Yards. It has been found possible to place specialized problems in some of these laboratories such as the development of chain and rope in the Boston Navy Yard. The assignment and progress, as well as general administration of all research, development and test work, is carried out by the Bureau of Ships in Washington in order most fully and effectively to coordinate all work and to collect, apply and distribute the results.

Under the Bureau of Ordnance there are the Dahlgren Proving Ground, the Naval Gun Factory at Washington, whose research department includes the Naval Ordnance Laboratory, the Naval Powder Factory near Washington and the Newport Torpedo Station. In addition there are establishments devoted to mines, counter-mines, nets and the like.

Under the Bureau of Aeronautics there is the Naval Aircraft Factory in Philadelphia, the Cedar Point Flight Testing Field near Washington and the Aircraft Armament Laboratory and Testing Field at Hampton Roads.

Research in medicine and surgery is directed by the Research Division of the Bureau of Medicine and Surgery, using many facilities but largely those of the U. S. Naval Medical Research Institute at Bethesda near Washington and the Medical Research Laboratories at Pensacola and New London.

Civilian Agencies. I pass now to the non-governmental scientific organizations in the United States, most of whose members are attached to the staffs of some 600 colleges, universities and engineering schools, some 2,000 industrial research laboratories and other specialized research institutes. Do not be alarmed when I begin by saying that these comprise well over one hundred nationally recognized scientific and engineering societies, exclusive of the social sciences. Of these, only a few are general in scope in the sense that they cover broadly the entire field of science. Largest of these is the American Association for the Advancement of Science, a close parallel to your British Association, with a direct membership of about 24,000 and an indirect aggregate membership of about a million through the 187 associated and affiliated societies. Of a more exclusive character and without the affiliated and associated societies are the American Philosophical Society and the American Academy of Arts and Sciences.

Unique among the scientific organizations of the United States is the National Academy of Sciences.

In March, 1863, during a crisis of our Civil War, Congress established the National Academy of Sciences and President Lincoln signed the Act of Incorporation. This act specified that "the Academy shall, whenever called upon by any department of the government, investigate, examine, experiment and report upon any subject of science or art, the actual expense of such investigations, examinations, experiments and reports to be made from appropriations which may be made for the purpose." There was also the provision in the charter that, except for the actual expenses of these activities, neither the academy nor any member of the academy is entitled to receive any compensation whatsoever for such services. Although the membership is legally limited to 450, the actual membership in the academy has never exceeded its present enrolment of 350.

Outside of its services in war-times, perhaps the most noteworthy public service by the academy was its geological and engineering investigation of the slides which at one time threatened to prevent the successful consummation of the Panama Canal. However, the utilization of the academy by the government has been rather "spotty." Under some administrations the academy has been used rather extensively and in other administrations has been more or less forgotten by the government. In this respect I believe that your Royal Society has had a more consistent role of usefulness.

One inevitable characteristic of this type of organization, in which membership is considered to be the highest scientific honor of the country, is that membership, like scientific recognition, is likely to come to a man after he has passed the peak of activity in his scientific career. For this reason the academy has been able to perform an excellent function of the "scientific elder statesmen" variety. It has zealously kept itself free from all types of political influence. Its ideals have been unselfish service, integrity and scientific competence. Frequently, however, probably in the great majority of cases, when a very active research program has to be undertaken, many of the personnel best adapted for the particular job are not found within the membership of the academy.

During the last world war in Europe, but before the United States had become a participant, President Wilson by executive order requested the National Academy of Sciences to establish the National Research Council as a measure of national preparedness. This organization operated so usefully during the war that after its termination, in April, 1919, the National Research Council was perpetuated by the National Academy of Sciences at the express request of President Wilson.

This National Research Council is organized into nine permanent divisions covering the various fields of scientific research and of scientific administration. These divisions are composed of appointed members and also of representatives from many of the scientific and engineering societies and branches of the government. Because of this wide representation the National Research Council is a most effective agency for finding just the right persons to do any specific scientific job.

During the present war the National Academy and the National Research Council have been called upon to perform many important services, some of an advisory character and some involving the placing of contracts for research and development work in various laboratories.

Among the nearly 200 committees operating under the National Research Council, the following are typical of those concerned with the war: Aviation Medicine, War Metallurgy, Passive Protection Against Bombing, War Use of Research Facilities, Tin Smelting and Reclamation, Clothing, Shock and Transfusions, Treatment of Gas Casualties, Wartime Diet and Selection and Training of Service Personnel. *(To be concluded)*

OBITUARY

HENRY SEELY WHITE

1861–1943

Henry Seely White, distinguished mathematician and professor emeritus at Vassar College, died on his eighty-second birthday, May 20, 1943, at his home on Overlook Road, Poughkeepsie.

Professor White's early years were spent in Cazenovia, N. Y., where his father, Professor Aaron

White, was principal and mathematics teacher in Cazenovia Seminary. In his seminary years the boy was introduced to farm life on his grandfather's lands and invited to take up that work, but, like Newton, he preferred academic activities to farming, and his chief contribution to the farm consisted of surveying, a task which he appreciated most for its temporary claim. He entered Wesleyan University and was graduated with honors in 1882. Twice he returned there for service, to assist in astronomy and physics the year after graduation, and again in 1884 as registrar and tutor in mathematics after an intervening year of teaching at Centenary College. Frequent trips to Wesleyan in later years and deep interest in its welfare gave testimony to his strong attachment to his Alma Mater and the honorary degree conferred on him at the Wesleyan Centennial in 1932 bespeaks the university's pride in him.

Between 1887 and 1890 Mr. White was at Göttingen in work that led to the doctorate. Here he responded to the stimulus of great mathematicians with a thoroughness and joy which characterized all his work. Whether through the influence of these years of close contact with the minds congregated in that Mecca of the era or through his own natural urge to wider fields, he developed a breadth of view and a catholicity of interest that marked his scholarship through the following years.

At Clark University, to which he was called on his return from European study, and at Northwestern University, where he was chairman of the department, his mathematical stature could be measured by the calls he was receiving to other posts. It was at Northwestern, in 1905, that President James Monroe Taylor, of Vassar College, after a nation-wide search for a distinguished mathematician, found in him the man he sought.

To Vassar's advantage he declined frequent further calls and remained to direct the Vassar Department of Mathematics for thirty-one years, an inspiration to students and colleagues who enjoyed the charm of his personality and the quality of his mind. His dry wit, his courtly bearing and his quiet, gentle insistence on work of substance expressed with clarity brought forth the best in his students. To the college community Professor White and his wife, a musician of note, provided generous hospitality which afforded valuable opportunities for additional acquaintance. They also helped to cement friendly relations between town and gown, Mr. White serving at one time as president of the Poughkeepsie University Club, at another as commodore of the Poughkeepsie Yacht Club, and both entering into various other local activities.

Professor White was one of the founders of the American Mathematical Society Colloquium Lectures. He served as editor of the *Annals of Mathematics* from 1899 to 1905 and of the *Transactions* from 1907 to 1914. He was president of the American Mathematical Society from 1906 to 1908, president of the American Association for the Advancement of Science in 1915, and was elected fellow of the National Academy of Science in the same year. The degree of doctor of laws was conferred on him by Northwestern University in 1915.

Publications by Mr. White in book form and as contributions to journals were concerned primarily with his interests in the theory of invariants, geometry of curves and surfaces, correspondences, plane and twisted curves, homeomorphic sets of lines in a plane and relativity in mechanics. His best known work was "Plane Curves of the Third Order."

With his vast fund of information Professor White was always ready to explore topics brought to his attention by others, beginners as well as mature workers, and shared his wisdom with genuine pleasure. His colleagues of various departments enjoyed the universality of his knowledge as well as his humor and friendly, constructive cooperation, and they continued to consult him during the years of his retirement from teaching. He never did retire from creative scholarly work nor from his connections with church and city groups, but remained a remarkably active and efficient person to the time of his death.

MARY EVELYN WELLS

VASSAR COLLEGE

ARTHUR TRAUTWEIN HENRICI

1889–1943

DR. ARTHUR T. HENRICI passed away on April 23, 1943, at the age of 54 years. To many of his friends the news of his death will come as a severe shock. His youthful appearance and active mind gave promise of many more years of productive and fruitful service. His associates, however, were aware of his failing health and were therefore somewhat prepared for the blow when it fell.

Dr. Henrici's Germanic ancestors migrated from Grosskarlsbach to Pittsburgh in 1825, where many of their descendants still reside. Born in Economy, Pa., on March 31, 1889, Dr. Henrici moved with his parents to Pittsburgh when a boy. Here he attended public schools and entered the medical school of the University of Pittsburgh in 1907, where he was graduated at the head of his class four years later. Upon graduation he received the Brinton Award in recognition of outstanding scholarship. Following graduation from the medical school, he served for about a year and a half as pathologist in St. Francis Hospital under the late Dr. Klotz.

In 1913 Dr. Henrici was appointed instructor in bacteriology at the University of Minnesota, where he spent the greater part of his distinguished professional career. He was made a professor of bacteriology in 1925. Following the outbreak of World War I, he enlisted in the Army Medical Corps. He served as captain with his unit in France until after the Armistice.

Dr. Henrici's research interests were largely in the fields of morphology and taxonomy. He soon became a recognized authority in these branches, so much so that he somewhat personalized these fields. In addition to his contributions to scientific journals, he is the author of "Morphologic Variation and the Rate of Growth of Bacteria," "Molds, Yeasts, and Actinomycetes" and "The Biology of Bacteria." He was a member of the Society of American Bacteriologists, of Sigma Xi and of Alpha Omega Alpha. He was associate editor of the *Journal of Bacteriology,* and in 1939 he served as president of the Society of American Bacteriologists. In 1941 he held the Walker Ames Lectureship at the University of Washington.

As a teacher Dr. Henrici had few peers. His clarity in presentation of data was a model of pedagogic technique. Dr. Henrici was loved and admired by his colleagues and idolized by his students. His death will long be mourned by all who knew him.

W. P. Larson

RECENT DEATHS

Fred Hall Kay, geologist, vice-president in charge of exploration and production for the Standard-Vacuum Oil Company, died on July 9 at the age of fifty-eight years.

Dr. Edith Hall Dohan, curator of the Mediterranean section of the University of Pennsylvania Museum, author, and member of several expeditions to Crete, died on July 14 at the age of sixty-five years.

SCIENTIFIC EVENTS

RESEARCH IN THE UNITED STATES

Nature makes the following comments on a recent statement made by Sir Ernest Simon before the Parliamentary and Scientific Committee concerning research in the United States:

> The research unit of the Bell Telephone Company, for example, has some 5,000–6,000 research workers concentrated on the one problem of telephonic communication. In the United States there seemed to be little need to persuade the business man, hard-headed though he be, of the value of research. He is now so firmly convinced by the results of the last twenty years, in peace and in war, of the necessity of research, that expenditure has risen to an astonishing figure, and, during the great depression, the research budget was the last to be cut. In 1940, according to an official report, industry was maintaining some 2,200 laboratories with a research staff of 70,000, at an annual cost of three hundred million dollars. Sir Ernest wondered what the expenditure is in Great Britain; he doubted whether it was £4,000,000, yet it was to be noted that the United States population was only three times greater than ours. Per head he estimated that the United States was spending five times as much as we spend on university and industrial research. The results were significant. America now leads in hydrocarbon research, the world order being now: United States first, Germany second, Russia third and Great Britain fourth. Yet coal is our only special large-scale natural resource, and success in the difficult post-war period in exporting enough to pay for our essential imports will depend to a substantial extent on the most scientific treatment of our coal in order to get from it the maximum value.
>
> This question of research is, of course, broadly divisible into two parts: research conducted by industrial organizations and research conducted by universities, and Sir Ernest Simon had some equally striking points to make concerning American universities. Their size and number is almost startling. When, during 1937–38, we had about 50,000 university students in Britain, America had a million. Their income was £97,000,000, while ours was just over £6,000,000. American grants from government authorities were ten times, and from private generosity, twenty times as great as ours. In engineering, for example, there were, in the same year, 12,000 graduates from the American schools compared with about 800 in Great Britain. Now none more than ourselves realizes that this comparison either of research or of numbers of universities and students may quite easily be very misleading. There are many factors which need close examination before final and valid conclusions can be drawn. The standards of graduate qualification must be closely examined and more particularly the work done by postgraduate students. The same care is needed when comparisons of arrangements for research are made, for research is a word capable of many interpretations. In saying that, we have no intention of attempting to detract from the vast and expert work of American research organizations and of American universities. By whatever test which may be applied it seems clear, from the points made by Sir Ernest Simon, that America has set and is setting an example which ought, without any avoidable loss of time, to be followed in Britain. The discussion which followed Sir Ernest's statement showed how the problem was appreciated by his listeners and gave indications of where research here should be encouraged and fostered.

VITAMIN D PATENTS

The following "special" has been sent from San Francisco to *The New York Times* by Lawrence E. Davies:

Patents covering production of vitamin D, reported to have yielded royalties exceeding $7,500,000 to the University of Wisconsin Alumni Research Foundation, have been held invalid by the Federal Circuit Court of Appeals.

The decision was written by Judge William H. Denman, with concurrence by Judge Albert Lee Stephens. Judge William Healy concurred in a separate opinion.

The case was taken to the Circuit Court by Vitamin Technologists, Inc., on appeal from a lower court at Los Angeles which had held the Steenbock patents valid and infringed.

The patents in question covered a process of producing vitamin D, known as a preventive of rickets, by subjecting foods to radiation of ultra-violet rays such as are obtained from the quartz vapor lamp.

"Primarily it is to be noted that the claim applies to all ultra-violet rays," Judge Denman wrote in the opinion. "It is not confined to such rays as are produced by a particular medium, such as the quartz lamp. It includes, of course, the ultra-violet rays of the sun.

"Many years before the application, science had discovered that the sun's rays shining on cut alfalfa hay cured in the field was an antirachitic food for pigs.

"Steenbock himself verified the facts concerning alfalfa by the discovery that when cured out of the sunlight it lacked the antirachitic quality exerted when cured in the field.

"We thus have the inventor proving that it is from the ultra-violet rays of the sun that the alfalfa acquires its vitamin D, that is, by the process claimed by him as patentable.

"If the patent be valid, it is thus seen that the farmer is an infringer when he exposes his cut alfalfa to the ultra-violet rays of the sun long enough to make it antirachitic.

"So also the long previously established practice of the radiation of milk by the mercury vapor lamp would infringe the monopoly of Steenbock's patent because, admittedly, in its customary use it would produce in the milk vitamin D."

The court asserted that Dr. Steenbock's "great contribution" to science and human needs was "his more exact recognition of what had transpired in all these prior practical uses of the ultra-violet rays in producing the then unnamed Vitamin D substances."

It added that the District Court had erred in saying that "nature, unaided by man, does not and can not antirachitically activate foods for medicines."

"The clear vision of such a scientific investigator as Dr. Steenbock well may create vastly higher indebtedness from the world of human beings than owed to the inventors of mechanisms and processes to whom his vision is the inspiration," Judge Denman's opinion continued.

"However, our Congress as yet has provided no system of reward to the pure scientist, while it has to the inventor for his processes and mechanism. Steenbock's valuable scientific certitudes are discoveries, but they are not inventions within the meaning of the term 'invention' as used by the Congress in its patent laws."

Judge Denman explained that Dr. Steenbock had been preceded by "the discovery by Hume and Smith" that rats, made rachitic, had their condition improved when put in a cage with a floor of sawdust into which ultraviolet rays had been radiated from a mercury vapor quartz lamp.

"They thought the radiation of the air the cause of the improvement," the opinion stated. "Steenbock discovered the improvement was caused by the antirachitic quality of the sawdust eaten by the rats. He did not invent a method, but merely discovered what happened in the prior known process."

The court ruled that there could be no infringement because the three patents in the suit were invalid.

THE NATIONAL METAL CONGRESS

PLANS for the twenty-fifth annual National Metal Congress in Chicago during the week of October 18 have been announced by W. H. Eisenman, managing director of the meeting and national secretary of the American Society for Metals.

Final arrangements for a War Conference Display have been completed. All activities will be concentrated in the Palmer House and other Chicago hotels.

The Metal Congress and Conference Displays will center on the increase of war production in the metal industry, to the conservation of metals and to postwar planning. All technical sessions and special daily War Production and Conservation sessions will be streamlined and comprehensive in their contributions to war problems. Mr. Eisenman states that during the past year the metal industry has largely finished its plant expansion job for war and now is confronted with production problems involving shortages of many strategic metals, more efficient use of equipment and continued training of personnel. All these problems will be discussed at the congress.

Four national societies will again cooperate in the congress. In addition to the American Society for Metals, there will be the American Welding Society, the Wire Association and the Iron and Steel and Metals divisions of the American Institute of Mining and Metallurgical Engineers.

War Conference Displays and the sessions of the American Society for Metals will be concentrated in the Palmer House, with the American Welding Society at the Morrison Hotel, the Wire Association at the LaSalle and the American Institute of Mining and Metallurgical Engineers at the Sherman.

The Conference Displays will be placed in the special rooms designed for light displays, which will accommodate light equipment and metal parts. Manufacturers are being urged to use models, moving pictures, photographs and literature to present new developments to the industry.

However, there will be no changes in basic facilities that will enable engineers, executives and production men to get together in one convenient and coordinated meeting place to help solve mutual problems and to bring to the attention of all the developments of the year in the metal industry.

THE NEW DIRECTOR OF THE U. S. GEOLOGICAL SURVEY

William Embry Wrather, consulting petroleum geologist, of Dallas, Texas, became director of the Geological Survey of the Department of the Interior at a recent ceremony in the office of Secretary of the Interior Harold L. Ickes. He succeeds Dr. Walter C. Mendenhall, who retired last February after serving in the survey for forty-eight years.

Following the administering of the oath of office by Chief Clerk Floyd E. Dotson, Mr. Wrather received the congratulations of Secretary Ickes and more than a score of bureau and division chiefs and Department of Interior officials. He has been confirmed in the position by the Senate. Previously Mr. Wrather's name had been proposed for nomination by a number of prominent geologists and scientific organizations, including a committee of the National Academy of Sciences especially appointed for this purpose at the request of Secretary Ickes, who wrote:

> I am confident that Mr. Wrather as its new director will add to the outstanding contributions that the Geological Survey has made in its long years of public service. It was my conviction that the selection of a director of this important scientific agency should not have a political consideration. I therefore requested the National Academy of Sciences to propose for the post the names of men who had high administrative ability as well as sound technical and scientific competence. Mr. Wrather was number one on the list provided by that body.

Mr. Wrather was born at Brandenburg, Ky., in 1883. He received his bachelor's degree at the University of Chicago in 1907 and studied at the Graduate School of that institution for two additional years. He was instructor in geology at the University of Chicago in 1922; the University of Texas in 1927; Yale University in 1930; Northwestern University in 1931, and the Southern Methodist University in 1935.

Mr. Wrather represented the National Academy of Sciences and the National Research Council at the International Congress at Madrid in 1926. He attended the National Geological Congress in South Africa in 1929. He was a member of the Organizational Committee of the Sixteenth International Geological Congress in Washington in 1933 and was a delegate to the Seventeenth International Geological Congress at Moscow, Russia, in 1937. For notable work in geology, he was awarded the alumni medal at the fiftieth anniversary of the University of Chicago.

The new director of the Geological Survey is a fellow of the Geological Society of America, in which he has held several offices; a member of the American Association for the Advancement of Science, of which he is a member of the executive committee; a former president of the American Association of Petroleum Geologists; a former president of the Society of Economic Geologists; a former president of the Texas Geological Society, and a member of the American Institute of Mining and Metallurgical Engineers, of which he was chairman of the Petroleum Division in 1933.

Mr. Wrather's professional work has been largely in the field of petroleum geology, but he is recognized as one having wide understanding and appreciation of the entire field of geology. He formerly served as associate chief of the Metals and Minerals Division of the Board of Economic Warfare.

SCIENTIFIC NOTES AND NEWS

Dr. Harlow Shapley, director of Harvard College Observatory; Dr. P. W. Bridgman, Hollis professor of mathematics and natural philosophy, Harvard University, and Dr. L. C. Graton, professor of mining geology, have been elected corresponding members of the Mexican National Academy of Sciences.

The William Osler Medal of the American Association of the History of Medicine has been awarded to George Edward Murphy, of the School of Medicine of the University of Pennsylvania, in recognition of his essay entitled "The Evolution of Our Knowledge of Rheumatic Fever." The essay will be published in the *Bulletin of the History of Medicine.*

The American Institute of Electrical Engineers on the occasion of the twenty-fifth anniversary of his election as an officer presented a scroll to Walter Irvine Slichter, professor of electrical engineering at Columbia University. He became an associate of the institute in 1900, member in 1903 and fellow in 1912. Sincere appreciation is expressed of his long-continued interest and his uniquely devoted and valuable services in the development of institute activities as director, 1918–22; vice-president, 1922–24; national treasurer since 1930, and chairman and member of many institute committees, 1910–1943. Presentation of the scroll was made by Professor Comfort A. Adams, president of the institute.

THE Melchett Medal for 1943 of the British Institute of Fuel has been awarded to Dr. E. S. Grumell, head of the coal research laboratories of the Imperial Chemical Industries, Ltd. This medal is being presented to Dr. Grumell in recognition of "outstanding work tending to the economical use of fuel which he has done over a long period."

PROFESSOR ALBERT EINSTEIN has joined the United States Navy Ordnance Bureau as a "staff member extraordinary" for research work on the phenomena governing explosives. He is working on a part-time basis for the Navy at the Institute for Advanced Study at Princeton.

A UNITED PRESS dispatch from Moscow to *The New York Times* states that the USSR on July 8 awarded the $30,000 Joseph Stalin Prize and the Order of Lenin for the invention of a simple turbo-generator to Professor Leonid K. Ramzin, the Russian electrical engineer. Under a decree issued by the Kremlin, the turbo-generator will bear the inventor's name.

THE College of Physicians of Philadelphia awarded the Alvarenga Prize on July 14 to Dr. Ernest Carroll Faust, professor of medical parasitology and acting head of the department of tropical medicine, Tulane University, for his "outstanding contributions to our knowledge of parasitology and tropical medicine." This prize was established by the will of Pedro Francisco Da Costa Alvarenga, of Lisbon, Portugal, an associate fellow of the College of Physicians, "to be awarded annually by the College of Physicians on each anniversary of the death of the testator, July 14, 1883, to the author of the best work in any branch of medicine which may be deemed worthy of the prize."

ST. OLAF COLLEGE conferred on May 30 the honorary degree of doctor of laws on Dr. Donald C. Balfour, head of the Mayo Foundation, Rochester, Minn., and the honorary degree of doctor of science on Dr. Adolph M. Hanson, Faribault, Minn., in recognition of work on the isolation of the active principles of various hormones.

DR. EDWARD B. STEPHENSON, principal physicist of the Naval Research Laboratory, Washington, D. C., was awarded the honorary degree of doctor of science at the commencement exercises of Knox College.

The Lancet reports that Sir Henry Tidy, president of the Royal Society of Medicine, London, has sent the following greeting to Professor George Mityerov, the People's Commissar for Public Health of the USSR: "On behalf of the 6,000 fellows of the Royal Society of Medicine, which has concerned itself with the science and culture of medicine since the year of its foundation in 1805, and which has actively concerned itself with matters regarding public health, I have the honor to congratulate the People's Commissariat of Public Health on the twenty-fifth anniversary of its foundation and to wish it all prosperity and ever-growing success. May the great work which it has achieved in raising the standard of public health in Russia during the last twenty-five years be amplified and improved at an ever-increasing rate both now and in the time that is to come when the defeat of the Axis, due to the joint efforts of the Allied Nations, will set free all our energies for the betterment of the lot of humanity."

DR. W. K. FISHER, since 1917 director of the Hopkins Marine Station of Stanford University at Pacific Grove, Calif., will retire on August 31 with the title professor of biology, emeritus. He will be succeeded by Dr. Lawrence Rogers Blinks. Dr. Fisher will continue research at the station as associate in zoology of the U. S. National Museum.

AT the School of Medicine of the University of Minnesota, Dr. J. C. McKinley, head of the department of medicine and director of the division of nervous and mental diseases, has been named head of the newly established department of neuropsychiatry, which includes the divisions of adult psychiatry and child psychiatry. Dr. Cecil J. Watson has been named head of the department of medicine and director of the division of internal medicine, and Dr. Raymond N. Bieter, professor of pharmacology, has been appointed head of the department of pharmacology to succeed the late Dr. Arthur D. Hirschfelder.

DR. GEORGE HUGH BOYD, professor of zoology and chairman of the division of biological science of the University of Georgia, has been named dean of the Graduate School. He succeeds as dean Dr. R. P. Stephens, head of the department of mathematics.

DR. T. DALE STEWART, curator and administrative head of the Division of Physical Anthropology in the U. S. National Museum, has been appointed visiting professor in anatomy at the Washington University School of Medicine for six months beginning on July 1.

DR. WENDELL H. TAYLOR, assistant professor of chemistry at Princeton University, has been appointed head of the Department of Science at Lawrenceville School, New Jersey.

THE trustees of the Lady Tata Memorial Fund announce that on the recommendation of the Scientific Advisory Committee they have agreed, if circumstances permit, to make awards for research in blood diseases, with special reference to leukemia, in the academic year beginning on October 1. Among those mentioned as recipients of grants is Dr. J. Furth, of the Cornell University Medical College, New York.

Dr. W. G. Ogg, director of the Macaulay Institute for Soil Research, Aberdeen, Scotland, has been appointed director of the Rothamsted Experimental Station to succeed Sir John Russell, who will retire in September.

An Associated Press dispatch reports that Surgeon General Thomas Parran has announced the appointment of Dr. Raymond A. Vonderlehr as director of district No. 6 of the United States Public Health Service covering Puerto Rico and the Virgin Islands. Dr. Vonderlehr recently completed eight years' duty as assistant surgeon general in charge of the division of venereal diseases.

Dr. Leverett D. Bristol, of Montclair, N. J., health director of the American Telegraph and Telephone Company, has been offered by the New Jersey State Board of Health the position of state health director, to succeed Dr. J. Lynn Mahaffey, of Haddonfield, who has resigned.

Captain Joseph N. LeConte, formerly with the Chemical Warfare Service, Fourth Service Command, Atlanta, has been promoted from the rank of first lieutenant to become chief of Chemical Section Inspection, Chemical Warfare Service, Washington, D. C.

Dr. Logan J. Bennett, biologist of the U. S. Fish and Wildlife Service, has been commissioned in the Naval U. S. Reserve as a Lieutenant (j.g.). He reported for active duty on July 15. Dr. Bennett has been with the Fish and Wildlife Service for the past eight years. From 1938 to the time of his enlistment in the Navy, he has been leader of the Pennsylvania Cooperative Wildlife Research Unit with headquarters at the Pennsylvania State College.

Donald McLaughlin resigned on July 1 as dean of the College of Engineering and chairman of the department of mining engineering of the University of California at Berkeley, to accept the position of vice-president and director of the Cerro de Pasco Copper Corporation, New York, N. Y. He is continuing as consulting geologist and director of the Homestake Mining Company and related companies.

Dr. Floyd S. Markham, associate professor of bacteriology at the Ohio State University, has left for North Africa to take charge of laboratories for the Typhus Commission of the Rockefeller Foundation.

The Lord President of the Council has promoted Dr. B. A. Southgate to be acting director of water pollution research in the British Department of Scientific and Industrial Research. He succeeds Dr. A. Parker, who has been made director of fuel research.

The Frederick Price Lecture of the Royal College of Physicians of Edinburgh was delivered on July 2 by Sir Henry Dale, president of the Royal Society. The title of the lecture was "A Prospect in Therapeutics."

Professor Edward Kasner, of Columbia University, recently addressed the Forum of *Scripta Mathematica* in New York on "Circles, Spheres and Geology."

By the will of Mrs. Harriette M. Arnold, of New York City, her residuary estate, amounting to $17,683,533, is distributed equally among St. Luke's Hospital, which also was bequeathed $50,000; the Metropolitan Museum of Art, New York Public Library, Trinity Church, Harvard College, Yale University and Princeton University. Other bequests include $100,000 each to Columbia University, Barnard College, Bard College at Annandale, N. Y., the General Theological Seminary of the Protestant Episcopal Church, New York Hospital and St. Mary's Hospital for Children, Inc. Among institutions receiving bequests of $50,000 are the University of the South, Sewanee, Tenn.; the New York Medical College Flower and Fifth Avenue Hospitals; Presbyterian Hospital in the City of New York, the Roosevelt Hospital and the Lying-in-Hospital. Bequests of $25,000 are made to Manhattan Eye, Ear and Throat Hospital, to Vassar College and to Smith College.

DISCUSSION

CIRQUES, HANGING VALLEYS AND HIGH-LEVEL BENCHES IN GLACIER NATIONAL PARK[1]

As shown on the topographic map of Glacier National Park there are, back in the mountains, numerous high-level cirques and relatively large benches on some of which are now small glaciers. Below these are nearly vertical cliffs 1,000 to 2,000 feet or more in height above the adjacent parts of the main valley floors. It has generally been considered that these features hang so high above the valley bottoms because the large Pleistocene trunk glaciers wore down their valley bottoms much faster than did the small tributary glaciers. It appears, however, that this is not the full explanation.

---

[1] Published by permission of the Director, Geological Survey, U. S. Department of the Interior.

Bordering the east front of the mountains there are, 1,000 to 2,500 feet or more above the intervening glaciated valley bottoms, remnants of old high-level piedmont benches which, near the mountains, are capped with much-weathered glacial drift, some of which is cemented to hard tillite. At corresponding levels farther out, similar bench remnants are capped with coarse, non-glacial stream gravel. When this ancient stream gravel and this old, weathered, early Pleistocene till were deposited the mountain gorges and the outer valleys were not so deep as now by 1,000 to 2,000 feet or more. If normal stream gradients, corresponding to the smooth, sloping bench tops, be projected back up the gorges to their heads, it is seen that many of the cirques, hanging side valleys and bench remnants are at heights corresponding in general with these projected old trunk valley bottoms. This relationship suggests that the tributary, V-shaped gulches and headwater hoppers which were later reshaped and enlarged by glaciation were genetically related to the positions of the late Tertiary or early Pleistocene valley bottoms. Down these valleys and out onto the smooth gravelly piedmont, the great early Pleistocene glaciers advanced, deposited their load and melted back up the valleys.

As a result of renewed regional uplift the streams then trenched the U-shaped early Pleistocene valley bottoms and cut V-shaped inner gorges to considerable depths before the last, or Wisconsin, stage of glaciation came on. Just how many interglacial stages there were in the region of Glacier Park is not definitely known; there were probably at least two. Each time the glaciers readvanced they deepened the valleys somewhat and they broadened the valley bottoms very notably by plucking and scouring away the lower side slopes. The broadening of the inner gorges by the readvancing glaciers was probably facilitated by the narrowness of the projecting craggy spurs between the numerous tributary gulches.

Such interglacial stream erosion both east and west of the Continental Divide undoubtedly accounts for much, if not most, of the Pleistocene valley deepening. The shapes of the inner gorges, the projecting spurs between the tributary gulches and the thin bedding and fractured condition of much of the sedimentary rock composing the mountains particularly favored the work of the glaciers in plucking masses of rock and wearing away and oversteepening of the lower side slopes. It seems to have been such a combination of alternating stream and glacial erosion which accounts for the lateral benches, hanging cirques and short tributary glaciated valleys being left so high above the bottoms of the trunk valleys down which the last of the Pleistocene glaciers advanced. Since the last of these great glaciers disappeared, the streams have accomplished relatively little erosion. There has been some, but not a great deal of, enlarging of the cirques by the small glaciers of Recent time.

Wm. C. Alden

GRAZING VERSUS MAPLE SYRUP

Three years ago at the request of A. C. Norris, an alumnus of Oberlin College, Miss Elaine Hoff, a graduate student in the department of botany at Oberlin College, undertook a cooperative study of maple groves in Lorain County, Ohio. Her analyses indicated that the quality of these groves was suffering from the fact that they were being used as pastures. One grower, R. E. Campbell, then fenced a grove containing 500 trees and excluded cattle, sheep and horses from it. An additional leased area gives a total of 1,425 trees covering about 225 acres which were protected or very slightly pastured. In the intervening two years, wildlife and tree seedlings have increased, and there have been some indications of increased sugar production, but it was difficult to obtain precise yield data. During the season just ended, however, the 1,425 trees which were protected from grazing produced an average of nearly 1 quart of syrup per tree against approximately 1 pint per tree from other groves in the neighborhood which have remained pastured. Furthermore, the unpastured area produced a yield of 40 barrels of sap after flow had ceased in the pastured woodlands. Previous to protection, the sap flow was no better than that of other pastured groves in the area. The 1943 yield represents an increase in gross income of $570 for the unpastured area. The area, rented for pasture, would have brought in less than half this amount.

While this test may not be conclusive, it is certainly significant, particularly in view of the fact that one of the most serious sources of economic waste in the North Central States is the grazing of woodlands and consequent destruction of undergrowth, including seedlings. Data accumulated by the Ohio Experiment Station indicate that an ungrazed, properly managed woodland can be quite as profitable as any acreage on the average farm. Other data indicate that enlightened practices of pasture management will yield nutrient values sufficient to reduce the area of feed crops and make unnecessary the use of woodlands for supplementary grazing.

Since writing the foregoing, I have had the following pertinent word from Dean L. E. Call, of the School of Agriculture of Kansas State College, in which he acknowledged my "letter of April 13, reporting on the yield of maple syrup from unpastured and pastured maple groves. The contrast is striking and is in complete conformity with the results that my brother has obtained where he has been protecting his grove from cattle for the last seven or eight years. Not only has the yield of sugar increased in his grove, but the condition of the trees is much better than it was at the time he started the practice. I spent a few days on his farm last August (the farm where I was born and raised) and I had never seen the maples in more thrifty condition than they were last summer."

Paul B. Sears

Oberlin College

THE MERITS OF ABSTRACTING JOURNALS

At the present time there are circumstances that give a special importance to abstracting journals. Part of the world's scientific literature, including some of the most used journals, is no longer accessible. Reprints of the articles are not distributed, and it has been difficult or impossible to find out what the publications are. As time has passed, since the beginning of the war, some sources have been found for certain otherwise unobtainable publications; but the limitations that exist preclude direct use of this by the ordinary scholar who is not fortunately situated.

In English and American serial publications titles and abstracts of some of this literature are appearing. They are scattered, often, in specialized bibliographic journals, and the coverage is necessarily incomplete and sporadic. Bibliographic agencies are in the best position to learn of and to make use of sources of the publications, if they are available anywhere; and by publication of titles and abstracts those agencies can provide information that could be obtained otherwise only with much difficulty and expense.

Biological Abstracts is the only comprehensive abstracting journal for biologists in English; its significance to biologists can not be too much emphasized. Organization of the results of contemporary studies into compact, easily consulted form is one of the most important services that can be given to students and investigators; and an extensive index like that which is prepared for *Biological Abstracts* is a very valuable guide to this organization. In doing justice to the literature of the world on a subject, the specialized abstracting journals have an advantage in that their energies and facilities can more easily be adequate to cope with their undertaking. The main difficulty that hampers the work of such comprehensive journals as *Biological Abstracts* is that so much more in energies and facilities is required that it is difficult to provide. The accomplishment realized in that journal, however, in the relatively few years it has been published, shows that the energy and interest are abundantly present in its staff and in the large number of biologists who collaborate. There is clear understanding, too, of the problems that need to be solved, and elimination of imperfections awaits only the provision of increased support.

The interests of all who make use of the results of research in science will be furthered if the support of established abstracting journals is made sufficient not only to continue and improve the permanent values of organization of reports, but also to carry on to the fullest extent possible the dissemination of information concerning current scientific research in nations with which free communication is at present absent.

Harold Kirby

Department of Zoology,
University of California,
Berkeley

QUOTATIONS

SCIENCE AND SOCIETY

In war Britain has learned that to neglect science is to court disaster. Before the war scientific research was far too commonly regarded as an activity remote from life, the practitioners of which could not be expected to make important contributions to solving the country's manifold industrial, social and human problems. Too little public or private money was spent on research. Expenditure on agricultural research, for instance, amounted to only a fraction of 1 per cent. of the value of the total output from the land, although a more generous endowment would have repaid itself economically many times over. Or, to take another example, research into the physical and psychological requirements of health in industry was hampered by lack of public interest and dearth of funds. Even more serious was the failure in far too many spheres of life to turn to practical ends the new knowledge which men of science were accumulating.

The basic facts about vitamins and food values were already well established when the Medical Research Council published its important report on "Vitamins: A Survey of Present Knowledge" in 1932. But very little was done, until the outbreak of war, to educate the public to a better appreciation of food values or to develop a food policy designed to counter the widespread malnutrition which was known to exist. Again, in a different field, there were undoubtedly unnecessary delays in the practical utilization of new inventions. Pre-war official investigations of the history of a number of the most important American inventions showed that from thirty-three to fifty years usually elapsed from the time of the first working model to the time when the invention had come into general use. There is little reason to doubt that the experience of Britain has been similar. It is understandable therefore that many scientists and technicians before the war increasingly came to feel that they should be "on top" rather than "on tap," since the "tap" was only too often not fully turned on.

Britain at war can not afford to dispense with science. It is at last safe to say that science has been granted a great measure of the recognition and facilities it requires. Great improvements in productive techniques, in the quality of war materials, advances in the design of aircraft, tanks and shipping, the development of radio-technology and many other devices, all testify to this. Thanks to the U-boat and to Lord Woolton and his scientific advisers, the public has taken tremendous steps forward in its nutritional knowledge. It is possible to believe that there is less malnutrition in Britain to-day than before the war. These are only some of the respects in which war-time necessity has compelled a better utilization of scientific and technical capacity. As a letter published on this page this morning points out, the neglect of the scientist and technician which was tolerated before the war will be as intolerable in the future as it would be now. The nation needs more science, in peace as in war, and must be prepared to pay for it. While science can not offer a utopian "age of plenty," Sir Robert Pickard, Professor Findlay and Sir Lawrence Bragg rightly insist that, in order to maintain and improve Britain's future standards of health and well-being, "scientific and technological research will be required on a scale not yet envisaged." If this fact is squarely faced and acted upon, and provided that experts are freely and fully consulted, few will disagree with our correspondents' judgment that a democratic community can not allow to the scientist, as scientist, a "position of exceptional authority in deciding the policies of governments." It is when the expert is ignored or frustrated that he becomes a "technocrat."—*The Times,* London.

SCIENTIFIC BOOKS

THE WORLD OF THE PHYSICIST

From Copernicus to Einstein. By HANS REICHENBACH. Translated by RALPH B. WINN. 123 pp. New York: Philosophical Library. 1942.

A PHYSICIST would infer from the title of this book that it would give a survey of all the great discoveries, all the great contributions leading us to our present knowledge of the physical universe. For in the time of Copernicus the world of the physicist was without form and void and darkness covered the deep mysteries of nature. During these 400 years light has entered. How the universe has grown as light supplied by a host of workers has at length allowed us to see vast bodies at distances "farther than ever comet flared or vagrant stardust swirled" or to penetrate into the inner recesses of particles in which masses and distances are measured in micro, micro, micro units. But the 123 pages of this book would hardly be adequate for the unfolding of the story. Its purpose is "to serve as an introduction to the great problems of space, time and motion. More definitely, it is concerned with the development (and glorification) of the theory of relativity. Its methods are very simple. No mathematical formulae or operations, no computations of any kind are introduced. It starts with the revolutionary view introduced by Copernicus—the earth does not stand still. The conservatives fought against his view. It belied the testimony of our senses. "So too do the revolutionary views introduced by Einstein."

From the consideration of motion and gravitation the book proceeds to the problems of light. What is light? Is there an ether? What did the Michelson and Morley experiment prove? According to the author it proved that there is no ether. And Einstein seized this result, "one of the greatest experimental precision." Thus "Einstein's theory of relativity, the most magnificent achievement of modern physics, was suggested by the closest adhesion to experimental facts" (p. 51). Unfortunately, however, it would appear that the author has never seen the interference fringes in a good interferometer and he has an extremely hazy view of the phenomenon of interference, for in explaining the Michelson and Morley experiment he states that "the belated arrival" of one of the beams "could be proved by the appearance of shadow bands." "Yet the surprising result was that no shadow bands appeared at all: there was no retardation of the ray" (p. 55). Shades of Michelson, Morley, D. C. Miller! The fact of course is that the interference fringes (shadow bands) were marvelously clear. What was looked for was a side shift of the fringes as the instrument was rotated so that the East-West arm became the N-S and *vice versa.* In the Michelson and Morley experiment no appreciable shift was seen, in the Miller case a partial shift (cause unknown) was detected.

The decrease in frequency, the increase in wavelength, of a spectral line sent out from an atom in a very strong gravitational field as compared with the radiation in a weak field is set forth, but again the author's knowledge of physics is greatly at fault. According to him "the number of vibrations of the light emitted by a *circulating electron* is a measure of the number of revolutions of the electron about the nucleus." That point of view, briefly held, was exploded thirty years ago. The author believes that the confirmation of this result of the relativity theory—the red shift of spectral lines due to strong gravitational fields—depends on the completion of the "Einstein tower" in Potsdam, "a structure combining to perfection every astronomical and physical contrivance," designed by E. Freundlich (who according to the translator was forced to leave Germany in 1933), who was to measure with high accuracy the dark lines of the solar spectrum. But the shift for radiations coming from dense stars has been found. It is several times greater than the computed solar shift and is in accord with the theory.

The book is intended to acquaint philosophers with some of the new aspects of matter and motion. But the author does not feel that it is necessary, perhaps not even advisable, to point out that some of these new properties, such as the increase of mass on account of motion, have an experimental basis entirely apart from the theory of relativity. It may be that the author desires to avoid, for himself and his probable readers, the difficulties involved in the elucidation of these experiments.

GORDON FERRIE HULL

RADIOLOGY IN INDUSTRY

Industrial Radiology. By ANCEL ST. JOHN and HERBERT R. ISENBURGER. Second edition. New York: John Wiley and Sons, Inc. 1942.

THE first edition of this book, entitled "Industrial Radiography," was published in 1934. The chief subjects of the first edition and of the present revised edition are the examinations by means of x-rays and gamma-rays of castings, forgings, welded joints, packaged materials, assemblies such as vacuum tubes and other industrial products. The authors are pioneers in this field of investigation. During the last five years, the use of the methods which they discuss has increased tremendously. Thus, they have an admirable background for describing the radiographic and fluoroscopic methods which are used for examining a great variety of the products of industry.

The new second edition contains in slightly revised form the material of the first edition. The discussions of gamma-ray radiography and fluoroscopy have been expanded in the new book.

The most important new material in the second edition is the expansion of the list of references in the field of industrial radiography. In the first edition, the bibliography at the end of the book lists 426 books and articles in technical journals. In the new edition, there are 1,314 items listed in the bibliography; some of these are as recent as October, 1942. The index is very usefully arranged. After each item of the index, page numbers appear, as in the conventional index; in addition, there are numbers in italics and these refer to the numbered references in the bibliography. Thus, if the book is used as a reference work, an item in the index will refer the reader not only to the material in the book on this particular subject, but also to the work of one or more writers who have presented their work in the technical literature.

No material is included in this book on the use of x-ray spectroscopy in industry. One might be led to believe that such material would form a part of "industrial radiology." Apparently, the use of x-ray spectroscopy in industry and the use of x-rays and gamma-rays for making fluoroscopic or radiographic examinations are two distinct fields; the authors of this book confine their attention to radiography and fluoroscopy, except for a brief note on the diffraction of x-rays in Chapter IV.

S. REID WARREN, JR.

MOORE SCHOOL OF ELECTRICAL ENGINEERING,
UNIVERSITY OF PENNSYLVANIA

ENZYMES

Chemistry and Methods of Enzymes. By JAMES B. SUMNER and G. FRED SOMERS. 365 pp. New York: Academic Press, Inc. 1943.

AN author of a book on enzymes, unless he writes an all-inclusive one such as Oppenheimer's Handbuch, faces the same problem as an anthologist. His choice and emphasis will follow his personal predilection or some definite plan. The authors of this book on enzymes appear to have followed the former method.

The enzymes are classified in the usual way into esterases, proteases, oxidases, etc. With the exception of urease, which is discussed as a possible important factor in the nitrogen cycle, no attempt is made to assess the functions of the enzymes in the cell. Perhaps as a consequence of this, the amount of space allotted to an enzyme is not commensurate with its known importance. For instance, under the esterases the cholinesterase is discussed in one and a half pages and no description of the methods of isolation is given, whereas chlorophyllase, the function of which is still unknown, is allotted more than two pages which include a detailed description of its preparation. Under the proteases, the methods for the crystallization of trypsin, pepsin, and various peptidases are described in detail almost as great as that found in Northrup's book on Crystalline Enzymes, but the methods for the crystallization of papain and ficin are not included.

The discussion of each enzyme begins with a short historical note followed by a list of organs or organisms where the enzyme has been found. With the exception of urease no data are given to indicate the relative concentration of the enzyme in the cells where it occurs. The action and specificity are then discussed and excellent formulae and equations are presented. This is usually followed by a description of the preparation and purification of the enzyme and a very useful outline of the methods for the estimation of its activity. The compounds which inhibit the enzyme are listed but the value of this is limited by the fact that neither the concentration of inhibitor, the conditions under which it acts nor the references are usually given. Moreover, the lists are generally far from complete. Eserine is the only inhibitor mentioned for the cholinesterase and 3 M urea the only one for the monamine oxidase.

The book begins with a simple and clear account of the general characteristics and properties of enzymes and ends with a chapter on carbohydrate metabolism and the Szent-Györgyi and Krebs cycles. This chapter includes the facts and theories made familiar by the numerous reviews that have recently appeared on the subject. The book on the whole is clearly and tersely written, well printed, and has only a small number of misprints. Enzyme chemists should find it useful particularly because of the formulae and methods of estimation which are given. Since, as the title implies, chemistry and methods are the main concern of the authors, the book may be considered to have achieved its purpose.

FREDERICK BERNHEIM

WILDLIFE REFUGES

Wildlife Refuges. By IRA N. GABRIELSON. New York: The Macmillan Company. 257 pp. 32 plates. 17 figs. 1943. $4.00.

FOR so many years it has been the fate of one who wrote of the wild life of the country to approach the subject with a feeling of despair, that it is quite a relief to find a book which is openly and frankly optimistic, a book which speaks of attainments rather than of defeats and losses. Instead of recording increasing additions to lost causes it contains references to 17,643,915 acres added to the national wildlife refuges and many other acres under private and public ownership. It is indeed heartening to read that "All together they are approaching adequacy," especially as it appears under the name of the director of the Fish and Wildlife Service. Here one may read the history of the movement from the early action by the California legislation in 1870, through a succession of similar events in a series of actions until finally in 1939 332,438 acres were added by the Resettlement Administration. These are all national efforts, to which must be added many more state refuges and numerous private grounds.

The book covers so much ground that it is impossible to note every phase of the treatment, but possibly a brief review of one topic, the Okefenokee swamp area, will serve to present the treatment. It is noted here that this area is impossible to classify, having inhabitants that would permit it to be designated as a migratory wild-fowl area, a big game refuge or a general wildlife refuge. The condition of the forest is much regretted, but it is pointed out that before many years have passed, it will be back in good form again, because of what still remains and because of the rapid growth of vegetation. The prairies are described and also the peculiar methods of travel. Only when he comes to a description of the animal life in the morning and evening of the day does the author's statement that "Okefenokee is marvelous" find justification. A brief general description of the swamp, in which the occurrence of the fabulous "sink holes" is vigorously denied, is followed by an account of the fishing, which is described as "locally famous." It is believed that this is a permanent condition, although the habit of going dry and burning is recognized as a handicap. Finally the author takes up the subject of the future of the swamp, pointing out the desire to restore it to its former state, but also indicating that some animal form such as the panther and ivory-billed woodpecker seem to be entirely absent now. Altogether the account ends most hopefully. Each topic in the book is taken up in a similar way, and the final picture is one of great hope and expectation.

C. E. McCLUNG

SWARTHMORE COLLEGE

SPECIAL ARTICLES

INTERFERENCE OF INACTIVE VIRUS WITH THE PROPAGATION OF VIRUS OF INFLUENZA

NOT much is known as to the optimal conditions for the propagation of the influenza A and B virus in the allantoic cavity of the chick embryo. In an attempt to gain this information it was found that the active virus as shown by titration in mice may reach maximal titer (50 per cent. mortality end point) in the allantoic fluid as early as 12 to 18 hours after infection, depending on the concentration of the inoculum. After attaining maximal concentration the amount of active virus decreased more or less rapidly with further incubation of the embryos until after 3 or 4 days frequently less than 1 per cent. of the highest titer was left.

In contrast to the active virus as titered in mice the red cell agglutinative reaction became positive in the allantoic fluid later and after reaching maximal strength the agglutinating titer remained more or less constant usually for at least 48 to 96 hours of incubation.

Using fluids collected at the height of active virus titer, subcultures ultimately reached equally high red cell agglutinating titers, regardless of whether undiluted or 10,000 to 100,000-fold diluted virus preparations had been used as inocula. However, when allantoic fluids were passed which had been harvested at a time when the active virus titer had decreased markedly, the growth of virus from a concentrated inoculum (0.5 ml of undiluted or 10-fold diluted fluid) was much less than the growth of the virus from an inoculum diluted 1,000-fold or more (Table 1). This paradoxical behavior had previously caused difficulties in the passage of some influenzal strains and even led to their occasional loss.

TABLE 1

RELATION BETWEEN THE CONCENTRATION OF THE INOCULUM AND THE PROPAGATION OF THE VIRUS

Inoculum* 0.5 ml diluted	Time of harvest (hours)	Titration in mice LD_{50} per ml† log	Agglutination of chick red cells units per ml
1 : 10	24	3.3	8
	48	2.0	48
	72	n.t.	48
	96	1.3	16
1 : 100	24	3.6	0
	48	4.3	224
	72	n.t.	192
	96	2.1	160
1 : 1000	24	2.0	0
	48	5.8	512
	72	4.5	640
	96	4.0	384

* Lee strain of influenza B.
† 50 per cent. mortality doses per ml.
n.t. = not tested.

It appeared possible that inactive virus accumulating with prolonged incubation could interfere on subculture with the propagation of the active virus in the allantoic sac. When active virus in optimal dilution (homologous or heterologous strains) was added to such "inhibiting" fluids and the mixture passed to chick embryos, the resulting formation of the red cell agglutinating agent was never higher than that in other eggs inoculated with a mixture of "inhibiting" fluid and saline solution. The use of normal allantoic fluid and normal chorio-allantoic membrane obtained from embryos of the same age as the "inhibiting" fluid did not prevent the normal propagation of the virus.

In an effort to demonstrate the "inhibiting" factor more clearly, attempts were made to inactivate the viable virus in fluids harvested 24 or 96 hours after inoculation. Heating of the fluids to 56° C. for 30 minutes or even 1 hour, or ultraviolet irradiation[1] under continuous mechanical agitation for 30 to 60 minutes usually inactivated enough of the virus to render them innocuous for mice, but sufficient concentrations of the active agent were left to initiate some multiplication when injected into the allantoic cavity of chick embryos. Although inactivation was incomplete, the following inhibition experiments have given clear-cut results.

Active virus was injected in optimal concentration into embryonated eggs either simultaneously with, or 3 hours following, the administration of the partially inactivated fluids described above, and the propagation of the virus was measured by titration of the allantoic fluids harvested 48 hours later either by inoculation of mice or by red cell agglutination. In each case the titers were reduced to those of the control fluids, prepared by injecting "inhibiting" fluid and saline solution. The experiment summarized in Table 2 shows that no red cell agglutination was noted after 48 hours and further incubation did not alter the result. Titration of the allantoic fluid in mice, on the other hand, revealed the presence of some active virus, which, however, amounted to only a fraction of 1 per cent. of the amount of virus found in the allantoic fluids collected from eggs inoculated with active

TABLE 2

INTERFERENCE OF PARTIALLY INACTIVATED VIRUS WITH THE PROPAGATION OF THE ACTIVE AGENT

First injection 0.5 ml	Second injection 3 hours later 0.5 ml	Results after 48 hours of incubation		
		Titration in mice LD_{50} per ml log	Red cell agglutinating agent units per ml	Complement fixation antigen units per ml
Irradiated virus* harvested 24 hours after inoculation (undiluted)	saline	4.0	0	0
	virus* 1 : 1000	4.3	0	0
Irradiated virus* harvested 96 hours after inoculation (undiluted)	saline	2.8	0	10†
	virus 1 : 1000	3.3	0	10†
Normal allantoic fluid	virus 1 : 1000	6.8	768	160

* WS strain of influenza A, allantoic fluid.
† Corresponding to originally injected antigen, no formation of antigen.

---

[1] A Hanovia Examalite quartz lamp was used.

virus following administration of normal allantoic fluid.

Similar interference experiments conducted in mice by the intranasal injection of partially inactivated virus preparations, followed 5 hours later by the active agent, have given results indicating that the same phenomenon may be demonstrated in this species. Protection against as much as 250 50-per-cent.-mortality doses was noted.

Interference of one virus with another has been observed repeatedly. The viruses may be quite unrelated or very closely related, as is the case with neurotropic and non-neurotropic strains of influenza Type A virus.[2] Interference of inactivated bacteriophage with the active agent of the same strain has been observed recently[3] and the present results extend these observations to the influenza viruses. It seems very likely from the data presented that virus having been inactivated during the process of cultivation may cause such interference phenomena and account for the difficulties encountered in the propagation of some strains of influenza virus. A more extensive report will be published elsewhere.

WERNER HENLE
GERTRUDE HENLE
UNIVERSITY OF PENNSYLVANIA

THE EFFECT OF CASTRATION AND TESTOSTERONE PROPIONATE ON d-AMINO ACID OXIDASE ACTIVITY IN THE MOUSE[1]

IN recent reports from this laboratory we have indicated the effect of castration and testosterone propionate on the activity of three hydrolytic enzymes.[2, 3] We now wish to report findings with respect to an oxidative enzyme, d-amino acid oxidase.

The mice were of an inbred stock, Buffalo-Marsh strain.[4] Castration and implantation of the testosterone propionate[5] pellets were performed when the mice were 18 ± gms body weight. The enzyme activity was determined by a modification of Elvehjem's method. The pyruvic acid formed in the presence of arsenite was determined by the 2,4 dinitrophenylhydrazone method.

The results in Table 1 demonstrate that the mouse kidney loses part of its ability to oxidatively deaminate d-alanine as a result of castration. The administration of testosterone propionate not only restores this property but increases it above normal. These data provide further evidence for our program to elucidate the nature and purpose of the protein anabolic properties of certain steroids originally observed in this laboratory in castrate dogs.[6]

TABLE 1

THE EFFECT OF CASTRATION AND TESTOSTERONE PROPIONATE ON THE d-AMINO ACID OXIDASE ACTIVITY OF MOUSE KIDNEY

Treatment*	No.	Weight of kidneys gms	Pyruvic acid formed			
			Total		Per gram	
			micromoles	Per cent.	micromoles	Per cent.
Castrate ..	6	0.259	20.1	– 70	75	– 54
Normal ...	5	0.402	65.5	..	164	..
Cast. and T. P.	3	0.545	108.0	+ 64	198	+ 21
Normal and L. P.	3	0.537	102.0	+ 55	190	+ 16

* Body weight at castration 18 ± gms. Treatment for 130 ± days.

The substrates incubated with mouse liver brei in no instance showed the presence of pyruvate. Either the mouse liver possesses no d-amino acid oxidase or it has a different mechanism than the rat for metabolizing pyruvate. We have been able consistently to find pyruvate in good amounts in substrates incubated with rat liver brei according to exactly the same procedure used for the mouse experiments. This difference in enzyme activity between the two species is not too surprising, for we have noted marked differences in the arginase and phosphatase activities in these same species.

L. C. CLARK, JR.
C. D. KOCHAKIAN
R. PHYLLIS FOX
DEPARTMENT OF VITAL ECONOMICS,
UNIVERSITY OF ROCHESTER

DIFFERENTIAL INHIBITION BETWEEN NORMAL AND TUMOR (CROWN GALL) TISSUE IN BEET ROOTS

A DISTINCT difference has been found by the authors in the action of resorcinol and of cyanide upon the rate of oxygen uptake in the tissues of normal beets and of beet root tumors induced by inoculation with *Phytomonas tumefaciens*.

With normal beet tissue an inhibition of 12 to 14 per cent. is obtained with 0.0166M resorcinol, whereas in tumor tissue this amounts to 20 to 23 per cent.

---

[2] C. H. Andrewes, *Brit. Jour. Exp. Path.*, 23, 214, 1942.

[3] S. E. Luria and M. Delbrück, *Arch. Biochem.*, 1: 207, 1942.

[1] This investigation was aided by grants from the Ciba Pharmaceutical Products, Inc., Summit, N. J., and the Josiah Macy, Jr., Foundation, New York, N. Y.

[2] C. D. Kochakian and L. C. Clark, Jr., *Jour. Biol. Chem.*, 143: 795, 1942.

[3] C. D. Kochakian and R. P. Fox, *Endocrinology*, 30: S1083, 1942.

[4] The mice were provided by the Biological Station, Springville, N. Y., through the courtesy of Drs. W. S. Murray and S. G. Warner.

[5] The testosterone propionate (Perandren) was supplied by the Ciba Pharmaceutical Products, Inc., through the kindness of Dr. E. Oppenheimer.

[6] C. D. Kochakian and J. R. Murlin, *Jour. Nutrition*, 10: 437, 1935; *Am. Jour. Physiol.*, 117: 642, 1936; C. D. Kochakian, *Endocrinology*, 21: 750, 1937.

inhibition. Similarly, it was found that cyanide in concentrations of 0.0166M inhibits the oxygen uptake to the extent of 84 to 86 per cent. in normal beets and of 79 to 80 per cent. in tumor beet tissue.

Previous work in this laboratory[1] has shown a differentiation between the healthy part and the tumorous part of the same beet, whereas the above work shows a differentiation between tumorous tissue and the tissue of an entirely healthy non-infected beet root.

Upon addition of cyanide to resorcinol, and *vice versa,* in the case of both healthy and tumorous beet root tissue, there is an increase in inhibition of 6 to 8 per cent. above that due to cyanide alone. These results are summarized in Table 1.

TABLE 1

EFFECT OF RESORCINOL AND CYANIDE ON THE RESPIRATION OF NORMAL AND TUMOR BEET ROOT TISSUE

Substance added	Per cent. inhibition Beet tissue slices	
	Normal	Tumor
Resorcinol	12–14	20–23
Cyanide	84–86	79–80
Resorcinol and cyanide ..	92	86

They suggest: (*a*) Tumors as well as healthy beets may have the following types of respiratory mechanisms: (i) cyanide insensitive system, (ii) resorcinol insensitive system, (iii) cyanide plus resorcinol insensitive system, as well as the corresponding sensitive systems, the relative proportion of the three systems in tumor and healthy tissue being different in each case. (*b*) The inhibitions brought about by cyanide and by resorcinol function to a certain degree independently of each other. (*c*) It appears possible that different active centers of the same enzyme (probably a heavy metal compound) are attacked by both inhibitors but to a different degree.

Experiments are now in progress to determine the nature of this differentiation between tumor and normal tissue.

The authors wish to thank the Carnegie Corporation of New York with whose financial assistance this work is being carried out.

MORITZ MICHAELIS
IRVING LEVI
HAROLD HIBBERT

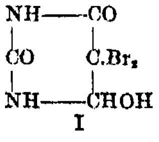
DIVISION OF INDUSTRIAL AND
CELLULOSE CHEMISTRY,
MCGILL UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SENSITIVE COLOR REACTION FOR THE DETECTION OF URACIL AND CYTOSINE[1, 2]

THE author will describe in this paper a modification of the well-known Wheeler and Johnson color test for the detection of the pyrimidines uracil III and cytosine[3] II, which has met with wide application since the date of its discovery in the Yale Laboratory.

The original test is based on the action of bromine on either of these two pyrimidines in aqueous solution, which reacts with them quantitatively with formation of 5,5-dibromoxyhydrouracil I. This hydropyrimidine is characterized by its reactivity towards barium hydroxide with which it reacts in aqueous solution to form (1)—isodialuric acid V and (2)—by rearrangement dialuric[4] acid VI. Both of these pyrimidines give insoluble, deep-purple colored barium salts by neutralization with an excess of barium hydroxide.[5]



I

Bromine water or liquid bromine are necessary reagents for the application of this useful test. There are, however, limitations in applying successfully the color test when uracil and cytosine are present in very small quantities; and furthermore, bromine is not always available in clinical laboratories for experimentation. The author also has experienced unexpected difficulties in detecting uracil and cytosine in the study of natural products containing mixtures of carbohydrates, purines and pyrimidines. He has, therefore, devised a new technique or modification of the original Wheeler and Johnson procedure[3] for testing for these two naturally occurring pyrimidines, which is an improvement on the original experimental procedure.

The new technique calls for only two common laboratory reagents, namely, concentrated hydrochloric acid and superoxol.[6] Advantage is taken, in this new application of the color test, of the known reactivity of hydrogen peroxide towards hydrochloric acid as is expressed in the equation below. The hypochlorous

$$HCl + H_2O_2 \rightleftharpoons HOCl + H_2O$$

acid formed in this reaction reacts immediately and quantitatively with uracil or cytosine if present in such a solution with formation of 5,5-dichloroxyhydrouracil IV. This chloro-compound reacts with barium hydroxide in a similar manner as the bromo-pyrimidine I, yielding the characteristic, purple barium salt of dialuric acid VI. The pyrimidine IV has previously been prepared in this laboratory by the action of chlorine water on uracil, and by the oxidation of uracil with potassium chlorate in hydrochloric acid solution.[7] In other words, the original color test for the detection of uracil and cytosine was dependent upon the formation of 5,5-dibromoxyhydrouracil[3] I, while in this new modification of the test 5,5-dichloroxyhydrouracil IV functions as the key pyrimidine reagent. The sensitiveness of the test has been increased by introduction of this new experimental technique.

---

[1] A. C. Neish and Harold Hibbert, *forthcoming publication.*

[1] Contribution from the Department of Chemistry, Yale University.

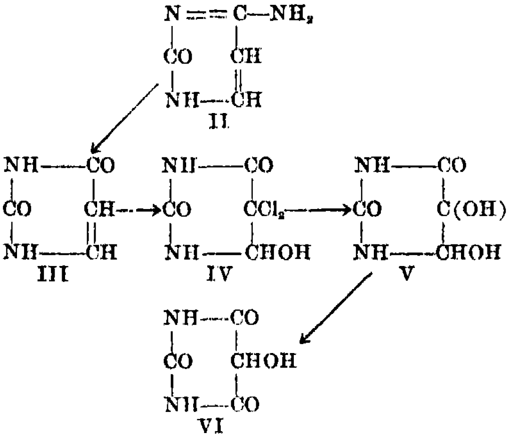
[2] "Researches on Pyrimidines," clxxx.

[3] Wheeler and Johnson, *Jour. Biol. Chem.,* 3: 183, 1907.

[4] Behrend and Koch, *Ann.,* 315: 246, 1901.

[5] Behrend and Roosen, *Ann.,* 251: 244, 1889.

[6] Hydrogen peroxide 30 per cent.—Merck and Company, Rahway, N. J.



EXPERIMENTAL PART

The Formation of 5,5-Dichloroxyhydrouracil IV by the Action of Hydrogen Peroxide on Uracil in Hydrochloric Acid Solution:[8] One gram of uracil was dissolved in 20 cc of concentrated hydrochloric acid and 15 cc of superoxol (Merck) added at 0°. Heat was gradually evolved on standing accompanied by evolution of oxygen, but without development of color. After allowing to stand at laboratory temperature for several hours (12 to 15), the solution was then transferred to a glass evaporating dish and exposed to a draft of air in a hood. Beautiful, glistening prisms began to form and increased in quantity until 1.0 g had deposited. They were identified as pure 5,5-dichloroxyhydrouracil[7] IV. The compound contained chlorine and decomposed with effervescence at 218°. This pyrimidine reacted immediately in cold aqueous solution with barium hydroxide yielding a brilliant purple precipitate of the characteristic barium salt of dialuric acid.

Analysis: Calc'd. for $C_4H_4O_3N_2Cl_2 \cdot H_2O$ N, 12.90
Found: N, 12.80, 12.75.

The acid solution remaining after filtering off the crystals of 5,5-dichloroxyhydrouracil IV responded immediately to the Wheeler and Johnson color test for uracil.

Method of Application of the Modified Wheeler and Johnson Color Test for Detection of Uracil and Cytosine: Use a 10–15 cc pyrex beaker for performing the test. Deposit on the bottom of this beaker 5–10 mg of uracil, or the mixed sample to be tested, and moisten with 0.5 or 1.0 cc of superoxol. There will be no apparent change or development of color. Then add from a pipette the same volume of pure concentrated hydrochloric acid (0.5 or 1.0 cc). Heat will be evolved and the uracil will finally dissolve, giving a perfectly clear solution. The mixture is then heated on a boiling water or steam bath when a violent reaction will set in with rapid evolution of oxygen. After subsidence of this reaction continue to heat at 100° until the mixture is reduced to a volume of about 0.5 cc and then cool. If uracil or cytosine were present in the test mixture, an immediate purple coloration or precipitate will be formed by addition of barium hydroxide solution until the reaction mixture shows an alkaline reaction. The whole operation can be conducted in an open laboratory hood, which is not the case when bromine is used in applying the test. Both uracil and cytosine are very sensitive towards hypochlorous acid.

In testing for the presence of uracil or cytosine in solutions of unknown concentration, a known volume should be evaporated almost to dryness before applying the hydrogen peroxide treatment for formation of 5,5-dichloroxyhydrouracil IV.

In Table 1 are recorded the results of a series of color tests applied to different reactants according to the new technique for detecting uracil and cytosine.

TABLE 1

A. *Reactants which gave positive tests confirming the presence of uracil or cytosine:*
   1. Uracil, uracil + thymine, uric acid + uracil, 4-methyluracil + uracil, cytosine hydrochloride, yeast nucleic acid + cytosine, 4-methyluracil + cytosine, glucose and uracil, thymine + cytosine.
   2. 2-Ethylmercapto-6-oxypyrimidine, 2-methylmercapto-6-aminopyrimidine.

B. *Reactants which gave no color test indicating the absence of uracil and cytosine:*
   1. Thymine, uric acid, 4-methyluracil, hydrouracil, 5-bromhydrouracil, 4-phenylcytosine, 4,5-dimethyluracil, yeast nucleic acid, 4-phenyluracil.

C. *Reagents used in applying the above color tests:*
   1. Superoxol, concentrated hydrochloric acid and barium hydroxide.

SUMMARY

(1) Uracil and cytosine are both transformed quantitatively into 5,5-dichloroxyhydrouracil by interaction with superoxol and concentrated hydrochloric acid.

---

[7] Johnson, *Am. Chem. Jour.*, 40: 26, 1908.

[8] See "Researches on Pyrimidines," clxxviii. Johnson, *Jour. Am. Chem. Soc.*, 65: 1943.

(2) This 5,5-dichloroxyhydrouracil reacts with barium hydroxide immediately at ordinary temperature giving the purple colored barium salt of dialuric acid.

(3) Both uracil and cytosine can be detected successfully in minute quantities by application of the technique discussed in this paper.

Treat B. Johnson

New Haven, Conn.

A NYLON BLOOD AND PLASMA FILTER[1]

The storage of blood and plasma has become commonplace within the last few years. However, these products frequently develop precipitates despite the use of what appears to be an adequate amount of sodium citrate as the anticoagulant. Although it is desirable that fresh blood be filtered immediately before administration to the patient, this precaution is mandatory when stored blood or plasma is used.

Materials such as cotton gauze, fiber glass braid, glass beads and stainless steel screens have been employed for filtration with varying degrees of success. More recently, Novak[2] has advocated a viscose rayon cloth.

During the past eight months we have been using a nylon[3] filter which has the following desirable characteristics: (1) It removes all clots without clogging; (2) it does not shed lint into the filtrate; (3) it is simple to clean, assemble, and sterilize by autoclaving, and (4) it is inexpensive so that the filter bag may be discarded after being used once.[4] The filter fabric has approximately 30,000 orifices per square inch; a double row of stitches with very fine nylon thread eliminates any danger of leakage. The bag has a filtration surface of approximately 50 sq. cm.[3] This is more than ample for the complete filtration of at least 500 ml of blood or 3,000 ml of plasma. Our failure to observe frequent clogging of this fine mesh filter is probably related to the fact that the nylon filaments are very smooth with round cross sections and aqueous solutions spread over the surface of the fabric without absorbing much moisture. The filtration of blood through the nylon fabric yields results that are comparable to those obtained with a standard 200-mesh screen.[5]

Fig. 1 shows the assembled filter. In use, the cannula is inserted into the appropriate orifice in the rubber-stoppered blood bottle, and the filter with its glass-covered drip tube remains suspended from the inverted bottle. The reservoir, tubing and 18-gauge needle are filled with saline. When the flow into the vein is definitely established, the filter assembly is inserted into the saline reservoir tube and the rate of blood flow is adjusted with the clamp to about 10 ml per minute. The unit simplifies the administration of blood or plasma because it includes the filter, the Murphy drip principle and the saline reservoir for starting the transfusion. No instance of sensitivity to nylon has been observed in over 1,000 blood and plasma infusions. No reactions have followed the administration of plasma in over 200 cases and the incidence of reaction with the use of whole blood has been very low. A further analysis of these data will be presented in a separate communication.

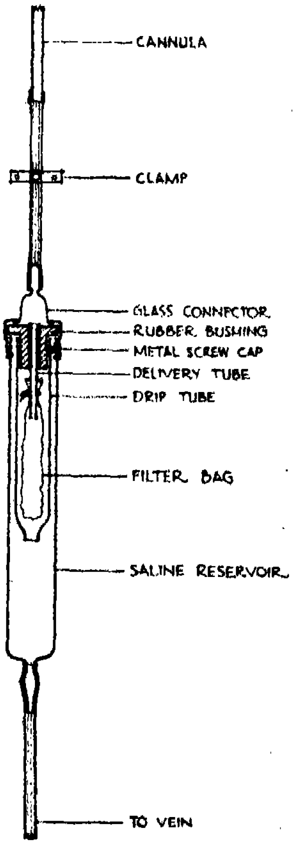


Fig. 1.

S. Brandt Rose

---

[1] Presented before the Academy of Surgery, Philadelphia, April 5, 1943, as a contribution from the Philadelphia General Hospital, Solution Room Committee, which also includes Dr. J. H. Clark, Dr. H. I. Hneleski, Dr. J. G. Reinhold and Dr. W. G. Turnbull.

[2] M. Novak, Science, 97: 248, March, 1943.

[3] The specially woven fine nylon fabric is known as "Hematex." The filter and fabric are available from Frederick H. Rhodes, Madison, N. J.

[4] Due to the current critical value of nylon the bags have been washed and used repeatedly. Immediately after use, the bag is rinsed blood-free in saline. At the end of the day, the accumulated bags are washed thoroughly in Dreft, a sulfonated fatty acid detergent marketed by the Procter and Gamble Company. The bags are then rinsed thoroughly in distilled water, boiled in distilled water for about 15 minutes, air-dried, assembled in sets with tubing and autoclaved. Each filter has been used at least twenty-five times.

[5] I am indebted to Dr. Max Strumia, Bryn Mawr Hospital, Bryn Mawr, Pa., for his kindness in performing this comparative test.

SCIENCE

Vol. 98 FRIDAY, JULY 30, 1943 No. 2535

Organization of American Scientists for the War. II: DR. KARL T. COMPTON 93

The Biochemistry of Anthocyanins: WILDER D. BANCROFT 98

Obituary:
Joseph Sweetman Ames: DR. LYMAN J. BRIGGS. *Recent Deaths* 100

Scientific Events:
Message from Chinese Men of Science; The Aquarium of the Zoological Park, London; The Resources of Virginia; Rare Chemicals; Gifts and Grants to the University of Wisconsin; The New Preference and Limitation Order on Laboratories and Laboratory Equipment; The Mathematical Association of America; The President of the Society of Chemical Industry 102

Scientific Notes and News 105

Discussion:
Census Areas for the United States, 1940: DR. CLARENCE E. BATSCHELET and MALCOLM J. PROUDFOOT. *Riboflavin-Vitamin B_2 in Soil:* PROFESSOR C. C. CARPENTER. *Apparent Time Acceleration with Age of the Individual:* F. W. NITARDY 107

Scientific Books:
Stratigraphy: Dr. H. E. VOKES. *Minerals and Rocks:* PROFESSOR C. S. HURLBUT, JR. *Qualitative Analysis:* DR. WENDELL H. TAYLOR. *Diseases of Domestic Animals:* DR. HERBERT L. RATCLIFFE 110

Special Articles:
Observations Concerning the Etiology of Primary Atypical Pneumonia: DR. HARRY M. ROSE AND ELEANORA MOLLOY. *Loss of Proprioceptive Reflexes Following Retrograde Degeneration:* DR. BERRY CAMPBELL 112

Scientific Apparatus and Laboratory Methods:
An Improved Instrument for Measuring Capillary Fragility: PROFESSOR R. A. WAUD and DR. H. G. SKINNER. *A Simplified All-Purpose Gravity Writing Lever:* DR. H. R. HULPIEU. *A Simple Timing Device for Speakers:* DR. NEAL A. WEBER 115

Science News 8

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

ORGANIZATION OF AMERICAN SCIENTISTS FOR THE WAR.[1] II

By Dr. KARL T. COMPTON

PRESIDENT, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

WAR-TIME SCIENTIFIC ORGANIZATION

In spite of the apparently complete peace-time organization which I have just described, it has always been our experience, in the time of great emergency, that it appears advisable to establish temporary new agencies to deal particularly with the emergency. For example, I happened to be attached to one of these temporary agencies during the last war and I mention the matter not only by way of illustration but also because it will enable me to relate an anecdote about your late distinguished colleague, then Sir Ernest Rutherford.

This agency was the Research Information Service, set up jointly by our Military Intelligence, Naval Intelligence and Council of National Defense, with offices in Washington, London, Paris and Rome. The function of these offices was essentially the same as that of the scientific liaison offices which have been operating so effectively between units of the British Commonwealth and the United States during the present war.

The head of the Research Information Service in London was the late Professor Bumstead, whom some of you doubtless remember. I was attached to the Paris office and happened to be temporarily in charge during the time when an allied conference on submarine detection was arranged in Paris under the auspices of this office.

One of the delegates from Great Britain was Sir Ernest Rutherford, who had been collaborating closely with the French physicist, Paul Langevin, in the development of underwater supersonic devices. The day before the conference, when the British and American delegations came over from London, Rutherford was not present, but he sent me a letter, delivered by Professor Bumstead, stating that some very recent experiments which he and his research assistant had been carrying on in the Cavendish Laboratory had apparently indicated success in disintegrating the nucleus of the hydrogen atom. "If this is true," Rutherford wrote, "it is a fact of far greater importance than the war." He went on to say that he was in the midst of a second experiment to check these startling findings and that he would be delayed a couple of days pending the termination of this experiment. Then Rutherford added as a postscript: "Tell nobody about this because I may be mistaken." Later it developed that what Rutherford had actually done had not been to disintegrate the hydrogen nucleus, but rather to disintegrate the nuclei of nitrogen atoms. So far as I know, Rutherford's letter to me was the first written indication of success in the long, long struggle to produce by artificial means a transmutation of one chemical element into another. I wish I had kept that letter and had turned it over to Professor Eve at the time when he was writing his interesting biography of Ernest Rutherford. But to return to our topic:

---

[1] Pilgrim Trust Lecture, under the auspices of the Royal Society of London, May 20, 1943.

I have frequently tried to analyze the reasons for the establishment of special scientific agencies during times of crisis. The reasons I think are varied and rather fundamental. One of them is that every great crisis involves conditions so different from the normal situation that the types of organizations which can survive and operate during peace-time are not adequate to meet the emergency. It may be, for example, that the emergency calls for exercise of very extensive administrative functions, such as the supervision of research projects and the disbursement of large governmental funds to a far greater extent than in peacetime. Hence a peace-time body of scientists organized primarily to exercise advisory functions may not be organized in a manner suited to prompt and efficient executive action. Another reason is the impossibility of always maintaining in the administrative positions of peace-time agencies the personnel who would be most effective for handling important projects in a war emergency. Men who have the proper capabilities are frequently too busy and too active in other directions to be willing to hold down positions in a peace-time organization which is relatively inactive. Consequently, when the emergency comes, the only alternatives may be to change the leadership in the existing organizations, a difficult if not impossible process, or to set up new temporary agencies to deal with the emergency.

Whatever the reasons may be, this present war emergency has run true to form and has resulted in the establishment of a group of special agencies of temporary character which I shall proceed now to describe. It is these agencies which are carrying the principal burden of the scientific research and development work related to the war, in the United States.

The National Roster of Scientific and Specialized Personnel was established early in July, 1940, when President Roosevelt approved a project for making available in one central office an index of all American citizens who have special scientific or professional skill. Headed by President Leonard Carmichael, of Tufts College, this agency operates under the War Manpower Commission under the Office for Emergency Management of the executive office of the President.

As a result of information secured from questionnaires mailed to all members of all scientific and professional organizations in the country, and supplemented by other information, an elaborate punch-card system has been set up in which practically every person in the country with specialized training or skill is listed with reference to his or her major professional fields and with the addition of a great deal of supplementary information regarding special interests, languages read or spoken, foreign countries traveled in, previous experience in the armed services or in industry, etc.

There are altogether 59 special fields listed in the Roster, falling under the general categories of administration and management, agricultural and biological sciences, engineering and related fields, humanities, medical sciences and related fields, physical sciences and social sciences. At the present time the total number of persons in this Roster is about 600,000, including, as of last October, 71,511 chemists, 7,297 mathematicians, 10,080 physicists or astronomers, 4,559 radio engineers, 14,729 electrical engineers, only 408 professional philosophers, and the smallest entry in the list is 142 speleologists.

As an illustration of the manner of use of this Roster I quote the following paragraph from a report by Dr. Carmichael: "How would you like to get an order for the names of all Americans who possess a knowledge of epidemiology and chemotherapy, who are competent in the diagnosis and control of *Endamoeba histolytica*, and other protozoan infections, have a knowledge of the Hindustani language, are skilled in the operation and use of specialized bacteriological research apparatus and who have traveled in the tropics?" To secure this information the stops of the punch-card sorting mechanism are pushed in at the appropriate places, the cards are ground through the machine, and all those which conform to the above specifications fall out together.

The Roster was originally conceived to serve governmental agencies who might request information on scientific personnel. More recently, as serious manpower shortages have developed both in industry and in education, and as the armed services have become more and more concerned over the most effective use of all scientifically trained personnel, the Roster has been used to an increasing degree in connection with placement work and to give the supply and shortage data on professional groups. Up to the middle of last month the National Roster had certified more than 140,000 names of specialists to various agencies engaged in the war program in the United States.

Office of Scientific Research and Development (OSRD). Most important of the scientific agencies established specially to deal with problems of this war is the Office of Scientific Research and Development, whose director is Dr. Vannevar Bush, president of the Carnegie Institution of Washington. It was created by executive order of the President in June, 1941, and under it operate the National Defense Research Committee, which had been established just a year earlier, and also the more recently established Committee on Medical Research. The OSRD is directed to coordinate, and where necessary supplement, the scientific research and development work relating to the war among civilian agencies as well as those of the government, including the Armed Services. To facilitate this coordination the advisory council to the director of OSRD includes high-ranking representatives from the War and Navy Departments, the chairman of the National Advisory Committee for Aeronautics, the National Defense Research Committee and the Committee on Medical Research and, by invitation, the president of the National Academy of Sciences and the director of the newly established Office of Production Research and Development of the War Production Board.

The principal research and development activities of the OSRD are carried on under contracts with appropriate research institutions, these contracts being financed out of an annual Congressional appropriation. At the present time these contracts involve expenditures at the rate of about $100,000,000 per year, and there are currently active about 1,400 contracts with about 200 industrial laboratories and 100 educational or special research institutions. About 6,000 scientists and engineers of professional grade are engaged on these contracts, with the assistance of a considerably larger number of technicians of various types.

To facilitate interchange of information between OSRD and our British colleagues, an OSRD Liaison Office was established with offices in Washington and London, now headed by Dr. Caryl P. Haskins and Bennett Archambault, respectively. These, in cooperation with the similar liaison services of Great Britain, Canada and, less extensively, Australia and South Africa, have served well to knit together our joint scientific efforts.

The National Defense Research Committee (NDRC) operates to recommend to the director of OSRD research and development contracts in the field of instrumentalities, devices and mechanisms of warfare. Under the chairmanship of President James B. Conant, of Harvard University, this committee is composed of four civilian scientists, plus one representative each from the Army and Navy, and the Commissioner of Patents. Feeding into it come the recommendations from 19 divisions, most of which are subdivided into several sections. These divisions and sections are each built around a specific functional concept, such as fire control or sub-surface warfare or explosives. However, there are two divisions which are in the nature of "catch-alls." For example, the Division of Physics and the Division of Chemistry can be defined as handling everything in these respective fields which does not fall under any one of the more sharply defined divisions.

In addition to the 19 divisions of NDRC there are two panels concerned respectively with applied mathematics and engineering. The difference between a division and a panel is suggested by the fact that the Fire Control Division, for example, is concerned with the development of fire control instruments, whereas the Applied Mathematics Panel is not concerned with the development of applied mathematics as such, but rather with the use of mathematics to aid in accomplishing the objectives of the various divisions. For this reason the applied mathematics panel includes membership on each divisional committee in which applied mathematics is likely to be important. The Engineering Panel serves all the divisions to expedite the transition from the stage of research and development to the stage of quantity production under Army or Navy contract.

Intimate contact between NDRC and its divisions on the one hand, and the Armed Services on the other, is maintained at several levels by an extensive organization of Army and Navy liaison officers who have proved invaluable as channels for acquainting NDRC with the needs and desires of the Armed Services for new equipment and for making arrangements for demonstrations and service tests.

Proposals for research or development projects come to NDRC from a wide variety of sources—requests or suggestions from the Army or Navy, proposals from industrial or academic research laboratories, promising inventions transmitted to NDRC from the National Inventors' Council, or in many cases projects originating within the NDRC committees themselves. However, the NDRC has complete freedom in making its decisions on the projects which it recommends to the director of OSRD and the priority attached to these projects, and the director of the OSRD has complete freedom in his own judgment to authorize the recommended contracts.

For reasons of security no person serves as a member of any NDRC committee unless he has been "cleared" by the Army and Navy Intelligence Offices, after investigation. Similarly, all personnel of the contractors working on the research and development projects are "cleared" by these intelligence offices to whatever degree is deemed advisable in virtue of the degree of secrecy attached to the project.

The Committee on Medical Research (CMR), under the chairmanship of Dr. A. Newton Richards, of the Medical School of the University of Pennsylvania, is in every respect parallel to the National Defense Research Committee in its organization and methods of operation. It deals exclusively with problems of war medicine such as shock, immunization or protection against types of diseases characteristic of the present theaters of war, etc. Though considerably younger and smaller than NDRC in both personnel and budget, it already has a record of substantial accomplishment.

Joint Committee on New Weapons and Equipment (JNW). The organizations described thus far have proven effective in organizing and administering research projects and in maintaining close relationships and exchange of information with the Armed Services and our British allies. In respect to the Armed Services, however, these relationships are primarily at the research and development level and for a time lacked one very important element necessary to make the work fully effective in the war. This missing element was an intimate relationship between the research and development agencies and the Highest Command of the Army and Navy who have the responsibility of planning the military or naval operations in which newly developed weapons might be used effectively or for which new devices should be developed. In order to fill this gap the U. S. Joint Chiefs of Staff in May, 1942, established the Joint Committee on New Weapons and Equipment, composed of Dr. Bush, director of OSRD, as chairman, the Assistant Chief of Staff G4 of the Army (now Brigadier General Moses) and the Chief of the Readiness Division of the Navy (now Rear Admiral De Laney).

JNW is charged by the chiefs of staff with correlating the research programs of Army, Navy and civilian agencies. It acts through subordinate bodies of which the special mission in which I am presently engaged in England is an example.

Through JNW any new weapon whose potentialities appear to be unusually significant is brought directly to the attention of the High Command for their consideration in the planning of future operations. Conversely, JNW offers a direct channel through which the High Command can pass down to the research scientists a request for development of any particular instrumentality which could be particularly effective in connection with some contemplated operation. This type of liaison between the scientists and the High Command is now in the United States. Its possibilities are still being explored and developed but it can be said definitely that it has already demonstrated its possibilities of great value in the war. It is a move in a desirable direction in which you have gone farther than we have gone.

National Inventors' Council. War is a great stimulus to invention, not only in the research laboratories of a country, but on the part of great numbers of its citizens, some of whom are technically competent and most of whom are uninformed but sincere in their desire to be helpful. Any actively operating research organization like the OSRD or the Naval Research Laboratory could be quickly bogged down under the deluge of ideas and inventions induced from all sources by the war. It is very important for purposes of morale that these inventors and would-be inventors be sympathetically handled. It is also important that their ideas be expertly examined to make sure that really worth-while ideas are not brushed aside, even though experience has shown that perhaps only one in one hundred thousand is new and significant.

To give such sympathetic and expert consideration and to screen the interesting suggestions out of the great mass, the National Inventors' Council was established in June, 1940, in close association with the U. S. Patent Office in the Department of Commerce, under the chairmanship of Dr. Charles F. Kettering, vice-president in charge of research for the General Motors Corporation. All suggested inventions relating to the war from any source and submitted to any agency or person in the government are channeled through this National Inventors' Council (unless they happen to come initially to an appropriate agency which is immediately interested in pursuing the matter). They pass through the hands of an expert staff of examiners who select those inventions which appear to have merit and bring them to the attention of the appropriate agency.

Office of Production Research and Development of the War Production Board. Until recently the organized war research efforts in the U. S. failed to include the very important category of research aimed at the development of substitute materials in fields where shortages exist, or of improved methods of production and manufacture. It was apparently assumed that the commercial interest of the production companies would lead them automatically to take care of this situation. However, under the pressure of war production orders, limitations of manpower and materials and financial regulations, the normal peacetime incentives to such research and development work by companies proved inadequate to meet the needs of the situation. Consequently, last September, there was established in the War Production Board an Office of Production Research and Development under the directorship of Dr. Harvey N. Davis, president of the Stevens Institute of Technology. This agency is still in the process of organization to operate somewhat along the lines of the Office of Scientific Research and Development but with primary responsibility for materials and method of production rather than devices and instrumentalities of warfare. It is regrettable that we did not have the foresight to establish this much-needed agency at a much earlier date, but it has already begun its operations and we hope that it may be enabled to play an important role during the balance of the war.

Engineering, Science and Management War Training Program. Though not directly concerned with scientific research, a review of the scientific war agencies in the U. S. would not be complete without at least a brief reference to the efforts to increase the supply of technically trained personnel to meet the increasing demand for such personnel in every field of war activity. In October, 1940, a special engineering training program was organized under the U. S. Office of Education and financed by Congressional appropriation. Later this program was extended to include also training in science and industrial management. It operates at both the collegiate and the technical school levels and its magnitude may be appreciated by the fact that, even in its first year of operation, it put through its specialized courses approximately ten times as many students as graduated in that year from the regularly established engineering colleges. Most but not all of the work was carried on in night schools, and the whole program has been decidedly helpful in relieving the technical manpower shortage.

Army and Navy Technical Training Programs. At the present time the Army and Navy are jointly establishing a very extensive program for the training of their own younger personnel in such fields as aeronautical engineering, naval architecture, electronics, communications, automotive engineering, etc., through contractual arrangements with several hundred of the nation's colleges and universities. Under these programs it is anticipated that approximately 250,000 selected young men in uniform will be detailed for this training at educational institutions during the coming year, the duration of such training to vary from field to field and individual to individual, in accordance with the needs of the situation and the performance of the individual. These special collegiate programs are intended to supplement, at the higher level, the very much larger technical training programs which the Army and Navy are conducting in their own establishments.

CONCLUSION

I conclude this factual, over-long, but I hope usefully informative address on a note of faith and optimism which I am sure is shared by the allied scientists on both sides of the Atlantic. Each of us concerned with some phase of the war effort is aware of some very significant new applications of scientific research in the war. For most of us, this knowledge is largely restricted to the special fields in which we ourselves have been working. Of necessity, the general public knows only in a vague way about some of these things and nothing at all about most of them.

When victory has been won, and the whole story of these scientific accomplishments can be told, it will indeed be a thrillingly interesting recital. Out of it all will come, not only its important contribution to victory, but a number of exceedingly significant results of permanent peace-time value. It is already evident that many of these war-time developments will have very useful peace-time applications, whose contributions to our standards of living and general prosperity and comfort will help to compensate for the ravages wrought by the war. Scientists will have a renewed faith in the worth-whileness of their work, and will continue their intellectual and practical endeavors with the increased power that has come from the experience of "team-work" on war problems. The general public, and especially the governmental and industrial leaders, will have greater appreciation of the value of science and scientists, both pure and applied—and this should result in permanently increased support of scientific research in the universities, industries and governmental agencies. These, I trust, will be some of the long-term gains to which we may look forward as the result of the temporary concentration upon practical problems of survival and victory which the war has forced upon us.

With these words of optimism, I close with the hope that the next American Pilgrim Trust lecturer to address you may not feel obliged to discuss the war, but will be able to treat of some interesting aspect of the progress of science in accord with the original conception of Sir William Bragg and as a happy feature in the post-war forward march of science.

THE BIOCHEMISTRY OF ANTHOCYANINS

By WILDER D. BANCROFT
CORNELL UNIVERSITY

A GREAT deal of work has been done all over the world on the chemistry of plant pigments. Very little work has been done anywhere on the stages through which the pigment develops in the living plant. This should be called the biochemistry of the plant pigments and is temporarily a neglected field of science. My attention has been called by Professor Bruce of Cornell to a book entitled "The Chemistry of Natural Coloring Matters" by Mayer and Cook, published in 1943. I can not find in it any information as to the probable precursors of the carotenes, to take one instance. If somebody would rewrite this book, making an exhaustive presentation of the biochemical side, he would have a masterpiece.

The red pigments in leaves, fruits and flowers and the blue pigments in flowers and fruits are mostly due to anthocyanins, though the red in the tomato, the watermelon, the berry of the mountain ash, the grape haws and the pink-fleshed Texas grapefruit is due to a lycopene. It is now known that anthocyanins are formed in plants in at least two different ways, through reduction of flavones or flavonols by ultraviolet light,[1] or through hydrolysis of what are called leuco-anthocyanins.[2] The latter reaction is often, but apparently not necessarily, accompanied by oxidation. There may be other ways of developing anthocyanins in plants; but this has not yet been proved definitely for any anthocyanin in any leaf, flower or fruit.

Light will not reduce flavones in a test-tube; but it will in some plants at some times. Therefore there must be found in some plants, under as yet unknown conditions, some substance or substances which will make flavones photosensitive. We do not yet know what this sensitizer is in any case. Flavones can be reduced electrolytically to anthocyanins,[3] but it is necessary to have a cathodic over-voltage. Consequently the reduction in the plant is undoubtedly an enzyme reaction.[4]

One important biochemical question is to determine the substance from which the anthocyanin is formed, and this has not been done in a great many cases. With leaves which turn red in the autumn it is a relatively simple matter to test the green and then the red one so as to determine the probable precursors of the anthocyanin. This was done by Rutzler[5] in some cases. Leuco-anthocyanin appears to be the precursor in 14 per cent. of the cases. The red autumn pigments of the leaves of the sumach, the dogwood and the barberry come from a flavone and those of the sugar maple, the Virginia creeper and the Seckel pear from a leuco-anthocyanin. The leaf of the Japanese creeper, when green, contains both flavone and leuco-anthocyanin. We do not yet know which gives rise to the anthocyanin or whether both do.

When the leaves come red before they turn green, another technique becomes necessary and one was apparently devised by Abbott[6] over thirty years ago. A small copper beech was kept partially covered in the spring, and the leaves under the sacking came green. When these green leaves were exposed to the sun, red could be detected inside of two days. Abbott of course did not test the green leaves for flavones or leuco-anthocyanins. Since light turns the leaves red quickly it seems probable that flavones were present. The development of enough acid to hydrolyze a leuco-anthocyanin would probably take longer.

We do not know whether the red leaves which appear as new leaves in the tropics could come green if the leaves were shaded, as Abbott did his. The botanists and the chemists have not yet got together on this point.

With red flowers one can not usually apply the leaf technique, because it is only in a few cases that we can examine the flower before and after it has turned red. Kuyper[7] reports that the flowers of *Hibiscus mutabilis* come out white at dawn and turn red during the day. Temperature is important in producing the color change. At temperatures under 16° C. there is practically no development of pink. This makes it probable that Kuyper was dealing with a leuco-anthocyanin.

Shibada, Nagai and Kishida[8] found that the flowers of *Diervilla grandiflora* S. and Z. bloom white; but turn rose color during the day. They did not test for a flavone; but they report that the colorless alcoholic extract produces a purple-red anthocyanin solution on reduction with mercury, magnesium and hydrochloric acid. This indicates that a flavone was present.

---

[1] Bancroft and Rutzler, *Jour. Am. Chem. Soc.*, 60: 2738, 1938.

[2] Robinson and Robinson, *Jour. Chem. Soc.*, 744, 1935.

[3] Chapman, Cornell University Ph.D. thesis, 1938.

[4] Wheldale, *Jour. Genetics*, 1: 113, 1911.

[5] *Jour. Am. Chem. Soc.*, 61: 1160, 1939.

[6] *Nature*, 80: 429, 1909.

[7] Kuyper, *Rec. Trav. bot. néerl.*, 28: 1, 1901.

[8] *Jour. Biol. Chem.*, 28: 93, 1916.

Sorby[9] found that by diminishing the exposure to light of a dark variety of the common wallflower, *Cheiranthus cheiri*, no anthocyanin developed, though this pigment was abundant in the flowers exposed to the sun. Apparently Sorby made no attempt to find out whether the phenomenon is general or is confined to this one flower.

We know now that the phenomenon is not general because von Sachs[10] says that "bulbs of hyacinths, tulips, etc., when germinating in profound darkness, nevertheless produce magnificent normal flowers, while the leaves at the same time become etiolated, though not strongly."

Askenasy[11] confirmed some of the results of von Sachs, but obtained a different result with *Hyacinthus orientalis*. The darkened flowers were not colorless, but they were distinctly a paler blue.

Hugo Fischer[12] says that the first appearance of color in the flower buds is generally two weeks before the time of blooming in the case of the red and blue flowers, and three to four weeks on the average with the yellow flowers. In order to minimize the disturbances of assimilation in the plants due to the cutting off of the light Fischer used small sacks or hoods of dark cloth which were not fully light-tight, but which let so little light through that one could ignore the physiological effect of the transmitted light.

When grown under a black hood the flowers of *Cydonia Japonica* [Japanese quince] were nearly pure white with just a touch of pink in the middle of each petal. Two weeks after the black hoods were taken off, the bleached flowers could not be distinguished from the normal ones.

When hooded, *Iberis umbellata* came almost completely white. *Campanula rapuncaloides, Phacelia Campanularia, Agapenthus umbellatus* and *Digitalis purpurea* were bleached somewhat, while *Althala rosea* (dark red) and *Dahlia variabilis* (double and pink) were distinctly paler but not much. On the other hand, no change could be detected with *Tradescantia virginia, Geranium pratense, Pelargonium zonale* (brilliant red) and a number of other flowers.

Although one of the yellow flowers, *Calendula officinalis*, which is a marigold, probably contains no anthocyanin, some of the petals, though not all, bleached to a pale yellow while the buttercup was unchanged.

Fischer says that there is absolutely no regularity to be found among the anthocyanins and that there seems to be no reason why one flower should bleach when grown in the dark and the other not. Fischer is ignoring possible chemical differences in the development of the anthocyanins. He could not avoid this in 1908; but we can do better now.

I read this paper by Fischer some years ago; but I read it uncritically, as apparently the other people did. I should have seen that Fischer had proved that there are at least two ways in which the plant can synthesize anthocyanin. In one case, the Japanese quince, no anthocyanin is formed when the flower is shaded; in the other case, typified by the geranium, anthocyanin is formed when the plant is shaded.

Since we know that there are two ways in which anthocyanin can be formed—[from flavones and from leuco-anthocyanins]—it seems natural to ask whether this fact will help us account for the work of Fischer and of others. If the anthocyanin is formed in the flower from a flavone it will not develop if ultraviolet light is excluded. If the anthocyanin is formed from a leuco-anthocyanin there is at present no reason to ascribe any appreciable effect to light, and the anthocyanin should form in the shaded flower. If the anthocyanin is formed in both ways in the flower, as we know it is in some leaves, we might easily get any intensity of color in the shaded flower.

It has not yet been proved that the shaded white flower of the Japanese quince contains flavone; but we know that nearly all normally white flowers do. Consequently, the white Japanese quince either contains flavones or there has been devised a method for preparing white flowers containing no flavone. While *this is not theoretically impossible, the burden* of proof is on the man maintaining it.

It is not clear how ultra-violet light gets into the flower bud three weeks or so before the flower blooms, and yet it must if keeping out the ultra-violet light prevents the formation.

If we water a geranium with a suitably buffered solution, perhaps a urea solution, we might be able to prevent the hydrolysis of the leuco-anthocyanin and should get white flowers which would turn red when treated with acid. I suggest urea because it is taken up readily by plant cells.

Fischer did not grow a white-flowered geranium, but he did not have any theory to guide him. Being professor emeritus I have no graduate students. Being crippled by a motor accident I can not do experimental research myself. All I can do is to point out what I think is important. I have the hope that some day it will interest some more competent person.

Somebody should extend Fischer's tests to cover all the known anthocyanins. We ought to have data on the ordinary lilac, pink carnations, peonies, oxalis,

---

[9] Sorby, *Proc. Roy. Soc.*, 21: 479, 1873.

[10] von Sachs, "Lectures on the Physiology of Plants," 384, 1882. Translated by H. Marshall Ward.

[11] Askenasy, *Bot. Zeitung*, 34: 1, 27, 1876.

[12] Fischer, *Flora*, 98: 380, 1908.

Christmas cactus, the red-bud or Judas tree, pink dogwood, phlox, cardinal flower, salvia and no end of other flowers. In Southern California one would include the bougainvillea.

Some red flowers, like the wild geranium, turn blue when exposed to ammonia and some do not. We do not yet know what substance should be added to the cell sap to stabilize the blue; but it should not be difficult to learn this. When we have done so, and when we have learned how to make a flavone photosensitive, we should be able to start with a plant which normally has red, white or blue flowers and make it flower either of the other two colors. We can make a hydrangea bloom red, white or blue; but this is not really a case of a patriotic posy, for we do not get the white by cutting off the ultra-violet so we are undoubtedly dealing with a different variety, as in the case of the white lilac.

It should be possible to ripen a strawberry without permitting any red color to develop. That would have no scientific value; but it would have news value.

When I was a boy we used to be told that a blackberry is red when it is green, but that is not necessarily true for a biochemist.

After the biochemistry of the anthocyanins shall have been straightened out people ought to start on the biochemistry of the carotenes and of lycopene. We know that the green tomato will turn red in the dark and of course there can be no ultra-violet light reaching the inside of the watermelon or of the pink-fleshed Texas grapefruit.

Willstätter and his successors have cleared up the chemistry of chlorophyll pretty well; but we still know very little about the biochemistry of chlorophyll.

Coming back to the anthocyanins, it is possible that zymin or reductase[13] is the enzyme or one of the enzymes that makes a flavone photosensitive. There is no proof of this as yet, but it may be true and will serve as a starting point.

SUMMARY

1. An explanation has been given for the effect of subdued light on the development of anthocyanins. This effect was observed by von Sachs and by Sorby seventy years ago. Nobody has made an exhaustive study of the subject, although Askenasy, Hugo Fischer and others have done work along these lines.

2. When a flavone is reduced to an anthocyanin, as with the Japanese quince, cutting off ultra-violet light prevents the formation of the anthocyanin.

3. When the anthocyanin is formed by the hydrolysis of a leuco-anthocyanin, cutting off of ultra-violet light will not necessarily prevent the formation of the anthocyanin. This occurs with the geranium.

4. We do not know at all approximately how many or which flowers belong to what I call the flavone type and how many or which to the leuco-anthocyanin type.

5. After the biochemistry of the anthocyanins shall have been worked out the botanists and chemists should concentrate on the biochemistry of the carotenes, the lycopenes and chlorophyll.

OBITUARY

JOSEPH SWEETMAN AMES

THE death of Dr. Joseph Sweetman Ames on June 24, 1943, brings to a close a long and eventful chapter in the history of Johns Hopkins University.

Dr. Ames' career is a striking example of a life devoted to one institution. Born on July 3, 1864, in Manchester, Vt., he went to Baltimore at the age of eighteen to enter the university. He won his baccalaureate degree in 1886, spent a short time in study in Berlin, held a fellowship in physics at his alma mater in 1887 and 1888, was assistant in physics the two following years, and received his Ph.D. in 1890. After graduation he continued his connection with the university and rose rapidly through the positions of associate and associate professor to a full professorship in physics in 1899. Following Professor Rowland's death in 1901 he was made director of the physical laboratory. He filled this post for a quarter of a century, when he was made provost of the university. The culmination of his university career came with his appointment as president of the university in 1929. In 1934 he announced that he would retire the following year, at which time he was made president emeritus. Unhappily the period of his career as president coincided with the worst years of the depression with an increased burden of financial problems.

In only one important instance did Dr. Ames share his university allegiance with another institution. He became deeply interested in the development of aeronautics through his appointment by President Wilson as a member of the National Advisory Committee for Aeronautics in 1917. For twenty years he was chairman of the executive committee of that agency, and through his guidance the committee's facilities for aeronautical research were expanded until they now comprise three great laboratories—at Langley Field, Va.; Moffett Field, Calif.; and Cleveland, Ohio. The committee's laboratory on the West Coast is officially named in his honor, although his failing health never permitted him to visit it. In all the years of his membership in the National Advisory Committee for Aeronautics, and particularly from 1927 to 1939, when he was chairman, he made frequent visits to the committee's laboratory at Langley Field and gave to its operations the same meticulous care which characterized his university work.

---

[13] Paladin, *Z. physiol. Chem.*, 26: 81, 1908; *Biochem. Jour.*, 18: 15, 1909.

Dr. Ames had the reputation of being blunt. To those who knew him well he was at heart the kindest of men. But to paraphrase one of the legends which surround the memory of Professor Rowland, Dr. Ames appeared to feel himself bound by an oath to speak the unvarnished truth as he saw it about the physical world, inanimate or not. Nevertheless, in any discussion he was preeminently fair. He would listen patiently to his adversary, whoever he might be. If he was thereby convinced that he had been in error, he would frankly admit it. If they failed to agree, he merely agreed to disagree, with no hard feeling of any kind. A meeting with a specified time schedule was to him an obligation to be met, and as chairman he carried it out to the minute, even if it left his unwary speakers gasping in the middle of a sentence, as it sometimes did. All this simply reflects the orderliness of his own mind. He had trained himself to present a subject in a logical way in a specified time and conclude it on the minute. Others could of course do the same if they would try hard enough. By sheer will power he conquered a speech impediment which troubled him much in his earlier years.

If former students of physics at Johns Hopkins were asked to name the outstanding characteristic of Dr. Ames, the answer would probably be his remarkable ability as a teacher. He was not primarily an experimentalist. In fact, the literature of physics contains very few investigations under his name. He was first and foremost a teacher in accordance with the best traditions of the university. The wide use of his text-book on "General Physics" was a tribute to the clarity of his exposition. He followed closely new theoretical and experimental advances in physics, and made every effort to keep his students informed regarding current developments. The journal meetings and seminars of the physics department under his personal direction were inspiring occasions, and the habits of thought there developed were destined to have a deep influence on the students who were privileged to participate.

So firmly did Dr. Ames hold to the importance and obligations of teaching that he continued to give his undergraduate courses in physics long after he became director of the physical laboratory. His classroom lectures were masterpieces of straightforward logical presentation. Even in his graduate courses he seldom referred to his notes. In his Joseph Henry Lecture before the Philosophical Society of Washington, which necessitated a manuscript for publication, he laid aside his manuscript at the beginning and presented his subject in characteristic style.

Dr. Ames was a member and past president of the American Physical Society; a member of the National Academy of Sciences; a fellow of the American Academy of Arts and Sciences and honorary member of the Royal Institution of Great Britain. He received the Langley Gold Medal in 1935 in recognition of his leadership in developing aerodynamic research. Washington College, the University of Pennsylvania and Johns Hopkins honored him with the degree of doctor of laws. He was a member of the Baltimore School Board and was president of the Baltimore Country Club for twenty years.

In 1899, Dr. Ames married Mrs. Mary B. Harrison. There were no children of this marriage, but he was deeply attached to his three step-children. Their home on Charlecote Place, Guilford, was a delightful place to foregather. He was a kindly and genial host and a skilful raconteur. After the death of Mrs. Ames in 1931 Dr. Ames lived alone in his home in Guilford until the end. A great teacher has passed to the realm of memory.

LYMAN J. BRIGGS

RECENT DEATHS

DR. WILLIAM FOGG OSGOOD, emeritus professor of mathematics of Harvard University, died on July 22 at the age of seventy-nine years.

DR. CARL EDWIN LADD, dean of the New York State College of Agriculture, Cornell University, died on July 23 at the age of fifty-five years.

DR. GEORGE FREDERICK KAY, professor of geology at the State University of Iowa from 1907 until early this year, dean of the College of Liberal Arts from 1917 to 1941, died on July 20 in his seventieth year.

DR. AGNES LOW ROGERS, formerly professor of education and psychology at Bryn Mawr College and director of the Phoebe Ann Thorne School, has died in Scotland. She was in her fifty-ninth year. Dr. Rogers had been professor of educational psychology at Goucher College and at Smith College.

DR. GEORGE ABRAM HARTER, professor emeritus of mathematics of the University of Delaware and president of Delaware College from 1896 to 1914, died in his ninetieth year on July 22.

CHARLES H. STERNBERG, collector of fossils and a contributor to museums in Munich, London, Paris, New York and Toronto, died on July 20. He was ninety-three years old.

Dr. Leonard S. McLaine, Dominion entomologist and assistant director of the science service of the Department of Agriculture, Ottawa, died on July 20 at the age of fifty-six years.

SCIENTIFIC EVENTS

MESSAGE FROM CHINESE MEN OF SCIENCE[1]

Professor Tseng Chao-Lun, head of the department of chemistry of the National Southwest Associated University, Kunming, China, has sent the following open letter to British scientific men:

> While the introduction of modern science into China dates back to eighty years ago, the real beginnings of scientific research in China came after 1919. On May 4 of that year, students in Peiping (then still called Peking) demonstrated against Japanese aggression, and from that incident was evolved the so-called "May 4th Movement," so important in the cultural as well as the political history of modern China. That movement, which quickly spread all over China, not only rallied the country to the standards of democracy but also promoted the natural sciences as factors in the modernization of China. With this impetus, scientific education and scientific research developed at a rate never dreamed of before. The progress made between 1929 and 1937 was particularly rapid, and constant encouragement was received from scientific workers in the United States and in Europe. Since the outbreak of the Sino-Japanese War in 1937, scientific institutions and scientific men in China have suffered tremendously through the deliberate efforts of the Japanese to destroy Chinese culture. But here in the hinterland of Free China, Chinese men of science have been laboring hard for the last five years in the interest of China and of science.
>
> Chinese scientific workers owe much to Great Britain for their training. For both democratic ideals and scientific accomplishment, we have always looked to Great Britain for guidance. Now, under the banner of the United Nations, Britain and China are fighting shoulder to shoulder to save democracy for the world; a new era of cooperation between the British and Chinese peoples has begun. Early this year we had the honor of welcoming a cultural mission from the British Council. One of its members is Dr. Joseph Needham, who is now doing most valuable work in our country, and who brought with him a large number of scientific books so much needed by us. Recently, Chinese science students in Britain, with the help of the British Ministry of Information, the British Broadcasting Corporation, the British Council and other organizations, have started a scheme for sending us science news, which includes a weekly broadcast summary of the principal contents of each week's issue of *Nature*; recent valuable scientific publications and microfilm copies are being sent, and scientific books are being collected with the view of establishing an adequate Science Library in China. Many British men of science are helping in these efforts. We shall never forget such things, and we hope they will develop into a bigger scheme of cooperation between the scientific men of Great Britain and China.

THE AQUARIUM OF THE ZOOLOGICAL PARK, LONDON

The Times, London, writes:

> One of the most popular pre-war attractions of the London Zoo, the aquarium, was reopened on June 11 in time for the Whitsun holidays.
>
> It had been closed since the beginning of the war for fear of the possible consequences if a bomb should hit one of the big tanks, water from which might then have flooded the tunnels used as air-raid shelters. So the exhibits were removed, and the sea-water was emptied from the tanks into the Regent's Canal—by which it used to reach the Zoo in barges after coming from the Bay of Biscay as ballast in ships' holds. Some time later a German bomb did in fact fall through the roof of the aquarium.
>
> In response to many inquiries by the public the fresh-water section of the aquarium has now been reconstituted, though necessarily on a more modest scale than before. The exhibition reflects much credit on the aquarium overseer, Mr. H. Vinall, who has got it together in face of many difficulties. He himself has made fishing excursions, with a drag-net, to acquire many of the British fresh-water fish now on view. Among them are trout, perch, roach, dace, bream, tench, carp and eels.
>
> The other exhibits are survivals from the pre-war aquarium and have been stored behind the scenes in tubs and all manner of receptacles. Most are cold-water fish, but the exhibition also includes five tanks of tropical fish, kept warm by electrical elements in the water. Some of the most vivid little tropical fish have been on view for the past year in the neighboring reptile house, which provides a suitable temperature for these miniature wonders of the deep, and they will remain there.
>
> In warm-water tanks in the aquarium are several species of cichlid and two lung-fish, one from Africa, the other from Australia. There are salamanders from China and Japan, American garfish and sunfish, the Mexican axolotl (which is capable of living on dry land) and a fine display of ornamental gold-fish. At the entrance is a large and attractive ornamental pool, inhabited by large carp and golden orfe.

THE RESOURCES OF VIRGINIA

Under "Science Notes" in *The Commonwealth* Dr. Sidney S. Negus reports that a committee has been appointed by W. Catesby Jones, president of the Virginia Academy of Science, to prepare an inventory of Virginia resources, including minerals, soils, agriculture, water, forestry, water power, transportation, labor, education, manufacturing, finances, research, climate, markets and specialized human resources such as in the field of scientifically trained manpower. Committees in other Southern states will do the same for their respective areas, the final data to be assembled by the Southern Association of Science and Industry.

---

[1] From *Nature*.

Dr. Marcellus H. Stow, head of the department of geology at Washington and Lee University and now on leave of absence with the War Production Board, and Clarence W. Newman, director of research of the Virginia State Chamber of Commerce and editor of *The Commonwealth,* are co-chairmen of the Virginia committee. Other members are Dr. Arthur Bevan, state geologist; T. E. Clarke, director of the Commission of Game and Inland Fisheries; Dr. T. B. Hutcheson, professor of agronomy, Virginia Polytechnic Institute; Dr. George W. Jeffers, professor of biology, Farmville State Teachers College; Raymond V. Long, director of the Virginia State Planning Board; Dr. Curtis L. Newcombe, director of the Virginia Fisheries Laboratory, and F. C. Pederson, state forester.

Dr. Negus states that there has also been appointed a committee to promote the incorporation in the school text-books of Virginia of information regarding the natural resources of the State and the South. Members of this committee are Francis S. Chase, secretary of the Virginia Education Association; Hubert J. Davis, chairman of the Virginia Junior Academy of Science; Dr. K. J. Hoke, head of the department of education, College of William and Mary; Dr. Dabney S. Lancaster, superintendent of public instruction for Virginia; Dr. Ivey F. Lewis, dean of the University of Virginia; and Dr. Wortley F. Rudd, dean of the school of pharmacy, Medical College of Virginia, chairman. There will soon be added to this committee a woman member. The Southern Association of Science and Industry hopes to have a similar committee in each State of the South.

RARE CHEMICALS

The following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

1. Copper Selenite Dihydrate (pure grade free from nitrogen)
2. Titanium Oxy Sulphate
3. Pure Estriol (Theelol) (500 mg)
4. Pure Indene (500 g)
5. Phlorhidzin (Phlorizin)
6. Parinoic Acid
7. Biallyl (1,5 Hexadiene)
8. Deca Tetra Enoic Acid
9. Octa Trienoic Acid
10. 1–3 Pentadiene
11. Ethyl Allene
12. P-Chlorobenzaldehyde
13. Dihydroxy Maleic Acid
14. Cyclopentene
15. Propargyl Chloride
16. Tetramethylene (Cyclobutane)
17. Vinyl Ether
18. Vinyl Ethyl Ether
19. Propyl Nitrite

GIFTS AND GRANTS TO THE UNIVERSITY OF WISCONSIN

Gifts and grants amounting to $108,650, of which $80,800 was from the Wisconsin Alumni Research Foundation, were accepted by the Board of Regents of the University of Wisconsin at its last meeting.

The large sum from the foundation was in the form of two grants, one for $77,500 to support university research during 1943–44, and the other for $3,300 for the renewal of a research fellowship to study the irradiation of dairy products and experimental work on vitamin D concentrates in the departments of dairy industry and biochemistry under the supervision of Professors H. C. Jackson, K. G. Weckel and Harry Steenbock.

The $77,500 grant to support university research is divided as follows: aid to professorial research, $25,000; symposium, $5,000; chemical engineering, $10,000; and unassigned assistantships and apprenticeships, $37,500.

Other gifts and grants were:

International Cancer Research Foundation, Philadelphia, Pa., $9,000, for renewal of a grant to carry on a study of the pathological cell multiplication in plants for a three-year period under supervision of Professor A. J. Riker.

The National Canners Association, $7,200, for renewal of research to determine the vitamin content of canned foods under supervision of Professor C. A. Elvehjem and F. M. Strong.

The Dr. L. D. LaGear Co., $2,500, for an industrial fellowship for a study of poultry diseases under Professors C. A. Herrick and James G. Halpin.

National Dairy Council, Chicago, $3,000, for the renewal of the third industrial fellowship for research on butter fat under Professors C. A. Elvehjem and E. B. Hart.

National Cheese Institute, Chicago, $2,000, for establishment of a third industrial fellowship to make a study of cheddar cheese under Professors M. J. Johnson, W. C. Frazier and W. V. Price.

Ludlow Manufacturing and Sales Co., Boston, Mass., $2,000, for the renewal of an industrial fellowship in the department of agronomy for the study of hemp under Professor A. H. Wright.

Grants of $500 and under were accepted from the American Medical Association, Chicago, from Yahr-Lange, Inc., Milwaukee, and from the Pure Milk Association, Chicago.

THE NEW PREFERENCE AND LIMITATION ORDER ON LABORATORIES AND LABORATORY EQUIPMENT

SCIENCE has received from E. H. Schaar, of Schaar and Company, Chicago, a copy of a circular letter explaining the new Preference Rating Order P–43 and Limitation Order L–144, together with copies of these two orders. He states that the circular was mailed to about 15,000 individuals in educational, governmental, institutional and industrial laboratories all over the country. It reads:

> On June 26, 1943, both Preference Rating Order P–43 and Limitation Order L–144 were revised completely. Since both of them directly affect your purchases of laboratory supplies, we want to tell you about the many new provisions. Enclosed are copies of the two Orders; we urge you to study them carefully. Note especially these points, which are of particular interest:
>
> 1. P–43 assigns a rating of AA–1 to serial-numbered laboratories, and a rating of AA–2 to all other laboratories.
> 2. Laboratories engaged in research or production control essential to the war effort may obtain a serial number.
> 3. Laboratories which already have a P–43 serial number may continue to use it. Those which do not may apply to WPB on form WPB–167.
> 4. Certain items may be purchased only with approval from WPB (see L–144, List A; apply on form WPB–1414).
> 5. Laboratories which do not have serial numbers must obtain WPB approval (using form WPB–1414) to place a single order for $200 or more, or to buy $50 or more of a single item.
> 6. If you are still waiting for delivery of any orders placed with us, rerate them at once in accordance with these new rulings. By rerating them promptly, you will materially expedite delivery, in many instances.
> 7. If you do not already have a serial number, and if you believe you are eligible to obtain one, apply for one right now.
>
> We shall be glad to give you any additional information we can, and to send copies of any of the forms you may wish to have. Just let us know how we can help.

THE MATHEMATICAL ASSOCIATION OF AMERICA

THE twenty-sixth summer meeting of the Mathematical Association of America will be held at the New Jersey College for Women, Rutgers University, New Brunswick, N. J., on Saturday and Sunday, September 11 and 12, in conjunction with the summer meeting and colloquium of the American Mathematical Society and the meeting of the Institute of Mathematical Statistics. Three sessions of the association will be held on Saturday, beginning at 10 A.M., 2 P.M. and 8 P.M.

The sessions of the American Mathematical Society will be held on Sunday and Monday. Three colloquium lectures will be given by Professor E. J. McShane, of the University of Virginia, the subject being "Existence Theorems in the Calculus of Variations." These lectures will be given at 9 A.M. on Sunday and at 9 A.M. and 2 P.M. on Monday. At 2 P.M. on Sunday Professor Antoni Zygmund, of Mount Holyoke College, will give an address on "The Complex Method of the Theory of Trigonometric Series."

The Institute of Mathematical Statistics will hold sessions on Sunday at 10:15 and 3:15 and on Monday at 10:15 A.M. there will be a joint session of the society and the institute.

On Sunday evening at 6:30 there will be an informal buffet supper for the three organizations at Wood Lawn, the Alumnae House of New Jersey College for Women. Following this supper at 8:30 P.M. the department of music of the New Jersey College for Women will give a musicale in the Music Building.

The Board of Governors of the association will meet at 10:15 A.M. on Sunday, September 12.

THE PRESIDENT OF THE SOCIETY OF CHEMICAL INDUSTRY

WALLACE P. COHOE, of New York City, has been elected president of the Society of Chemical Industry, according to word received from the international headquarters of the society in London. Mr. Cohoe, who is technical adviser to corporations, principally in the fields of textiles, synthetics, paper and cellulose, succeeds Dr. William Cullen, chemical consultant of London, who for more than half a century was associated with the Nobel Explosives Company, Ltd., of Glasgow and South Africa.

Dr. Cullen, who will serve as chairman of the council during the administration of Mr. Cohoe, states that closer world relations among industries employing chemists and chemical engineers will be a chief objective of the society in the coming year.

The Society of Chemical Industry, founded in 1881, has approximately 5,000 members throughout the world. It is composed of eighteen sections. England has eleven sections, Canada five, the United States one and Australia one. The chairman of the American section is Dr. Foster D. Snell, of Brooklyn, N. Y. Mr. Cohoe is planning a trip to England to develop a program for the expansion of the activities of the society. Sections will be established in New Zealand, South Africa and India after the war. He will visit all Canadian sections to coordinate their work with that of the American and other British sections. He has been vice-president of the Society of Chemical Industry and chairman of the American and Canadian sections. He is a member of the American Chemical

Society, the American Institute of Chemical Engineers, the American Institute of Chemists and the American Association for the Advancement of Science.

Mr. Cohoe, who was born in Norwich, Ontario, in 1875, is the sixth American president of the society. The others were Dr. C. B. Chandler, Dr. William H. Nichols, Professor Ira Remsen, Professor Marston T. Bogert and Dr. Arthur D. Little.

SCIENTIFIC NOTES AND NEWS

Dr. George D. Birkhoff, Perkins professor of mathematics at Harvard University, has been elected an honorary fellow of the Royal Society of Edinburgh.

Dr. Kenneth E. Caster, assistant professor of geology and fellow of the Graduate School of Arts and Sciences of the University of Cincinnati, has been elected a corresponding fellow of the Instituto de Estudios Superiores of Uruguay.

The National Society for the Prevention of Blindness has awarded the Leslie Dana Gold Medal, given annually "for outstanding achievements in the prevention of blindness and the conservation of vision," to Dr. Walter B. Lancaster, of Boston, consulting ophthalmic surgeon at the Boston City Hospital, the Massachusetts Eye and Ear Infirmary and the Massachusetts General Hospital, in recognition of "long meritorious service." Dr. Lancaster, though eighty years old, is in active practice as an ophthalmologist. The award is given by the St. Louis Society for the Blind on the recommendation of the Association for Research in Ophthalmology.

A list of honors to Canadians conferred by the King of England "on the occasion of the celebration of his birthday and on the advice of Canadian Ministers," as given in *Nature*, includes the following names: *C.M.G.:* Professor C. J. Mackenzie, acting president of the National Research Council of Canada; Professor W. G. Penfield, head of the Neurological Institute, Montreal. *C.B.E.:* Dr. A. E. Archer, president of the Canadian Medical Association; Professor J. B. Collip, president of the Royal Society of Canada; W. E. Phillips, president of Research Enterprises, Ltd.

Dr. E. W. Smith, president-elect of the British Institute of Fuel, has been awarded the Birmingham Medal of the Institution of Gas Engineers, in recognition of "his outstanding work during the past thirty years for the gas industry."

A wireless to *The New York Times* reports that honorary fellowships awarded by the Royal College of Surgeons, London, and presented at a reception given on the evening of July 21, include the following Americans: Colonel Elliot C. Cutler, Moseley professor of surgery, and Dr. R. B. Osgood, professor of orthopedic surgery, at Harvard University; Dr. Evarts A. Graham, professor of surgery at the Medical College of Washington University, St. Louis, and Dr. Howard C. Naffziger, professor of surgery in the Medical School of the University of California, San Francisco, chairman of the sub-committee on neurological surgery of the National Research Council. Dr. Naffziger was the only American present at the reception at which the awards were made. On this occasion a message was received from the King of England, who sent his best wishes to the college and expressed his hope that its museum, damaged by a German bomb two years ago, would be restored as soon as possible after the war.

Professor Arthur G. Ruggles, after forty-one years of service in the division of entomology of the University of Minnesota, retired from active service on June 30. For twenty-five years he served in the dual capacity of teacher and state entomologist. He continues work in the State Department of Agriculture in an advisory capacity.

At the Medical School of the University of Minnesota, Dr. Harold A. Whittaker has been promoted to a clinical professorship of preventive medicine and public health; Dr. Ralph T. Knight to a clinical professorship of anesthesia, and Dr. Wallace D. Armstrong to a professorship of physiological chemistry.

Dr. Donald Duncan, professor and head of the department of anatomy of the School of Medicine of the University of Buffalo, has been appointed professor of anatomy at the School of Medicine of the Louisiana State University.

Dr. John R. Mohler, chief of the Bureau of Animal Industry of the U. S. Department of Agriculture, has retired after serving in the bureau for forty-six years. He will be succeeded by Dr. Arthur W. Miller, assistant chief of the bureau since 1928.

With the retirement on July 1 of W. W. Mackie, agronomist in the Agricultural Experiment Station of the University of California at Berkeley, the activities of the division of agronomy have been transferred to Davis. Dr. Mackie is on leave from the university, to assist the Imperial Rice Growers Cooperative Association as consultant in the production of rice.

Dr. E. B. Krumbhaar, professor of pathology at the University of Pennsylvania, has been appointed a member of a committee of the Harvard Overseers to visit the Medical School and the Stillman Infirmary.

Robert W. Hodgson, professor of subtropical horticulture in the College of Agriculture of the University of California at Los Angeles, has succeeded Dr. William H. Chandler as assistant dean of the college.

Dr. Erwin V. Moore, a veterinary physician of Cortland County, has been named an assistant state agricultural commissioner of New York. Dr. Moore is a son of Veranus A. Moore, a former dean of the New York State College of Veterinary Medicine. Earl C. Foster, of Clinton, has also been named an assistant commissioner.

Dr. R. P. Dinsmore, since 1939 development manager of the Goodyear Tire and Rubber Company, who until recently served as assistant deputy director of the synthetic rubber program of the Government, has been elected vice-president of the company in charge of research and development.

Professor Maurice L. Tainter, of the department of pharmacology of Stanford University, has become research director of the Winthrop Chemical Company, Inc., Rensselaer, N. Y.

Chemical and Engineering News reports that Dr. Hans F. Winterkorn, of the University of Missouri, has become associate professor in civil engineering at Princeton University, where in addition to teaching he will be in charge of a research project sponsored by the Civil Aeronautics Administration on chemical stabilization of airdrome soils.

Dr. Robert M. Herbst, professor of organic chemistry at New York University, has become director of research for the firm of E. Bilhuber, Inc., Orange, N. J.

It is reported in *Chemical and Engineering News* that Otto A. Reinking, head of the division of plant pathology of the New York State Agricultural Experiment Station, has joined a mission to Costa Rica, where it is hoped to establish a quinine industry.

Dr. Philip Work has resigned as professor of neurology and head of the department at the School of Medicine at Denver of the University of Colorado, to become a lieutenant colonel in the Medical Corps of the Army.

Dr. William W. Krauss recently gave a series of four lectures on race biology under the auspices of several departments of the University of Colorado and the Colorado chapter of Sigma Xi. The series comprised lectures on European race problems, the Negro and mulatto problem, the races of the Far East and race-crossing in Hawaii.

Dr. Karl Lark-Horovitz, head of the department of physics at Purdue University, gave a series of lectures on physics, its application to chemistry and biology and the teaching of science, under the auspices of the Research Council of Iowa State College on July 22, 23 and 24.

The seventy-third annual convention of the American Institute of Civil Engineers was held at Los Angeles, Calif., on July 28, 29 and 30.

The fourth Conference on Science, Philosophy and Religion in their Relation to the Democratic Way of Life will be held at Columbia University from September 9 to 13.

The annual summer meeting of the Pennsylvania Academy of Science will be held at Reading on Friday and Saturday, August 13 and 14. Meetings will be held at Albright College and at the Reading Museum. Geological and botanical field trips are planned to Mt. Penn and vicinity.

The National Foundation for Infantile Paralysis has made a five-year grant of $175,000 to the University of Minnesota for a special study of the effects of the disease on the human body and methods of treating it. The Minnesota unit is the fourth long-range research project set up. The others are at the Johns Hopkins University, Yale University and the University of Michigan.

The Medical School of the University of Minnesota has received an annual appropriation from the State Legislature of $15,000 for special research in the field of cancer. The school has also received a continuation of the grant of $10,000 a year by the Citizens Aid Society in support of cancer research and the program of cancer education, and the continued annual gift of $5,500 by the Citizens Aid Society in support of the George Chase Christian professorship in cancer research; a grant of $5,000 from the Jane Coffin Childs Memorial Fund for Medical Research has been made for the support of the work of Dr. John J. Bittner and Dr. Robert G. Green and associates in the departments of physiology and bacteriology on the nature and mode of action of the milk influence in mammary cancer; a grant of $3,500 a year for a two-year period has been made by the Commonwealth Fund of New York toward the support of the Psychiatric Clinic for Children. Toward the support of this clinic the Stevens Avenue Home of Minneapolis will continue its grant of $10,000 for the year beginning July 1, 1943; a grant of $3,000 has been made by Parke, Davis and Company to establish a fellowship in clinical hematology in the department of anatomy, under the supervision of Dr. Hal Downey.

Two grants amounting to $9,000 have been made to Stanford University for the use of the department of biology in research on plant heredity in relation to food essentials. The Research Corporation of New York has given $3,000, which will be used during the summer in the work of finding mutant strains not now available. The Nutrition Foundation, Inc., has renewed a grant of $6,000 to provide four fellowships for work in developing specific microbiologic assays, primarily for amino acids.

ANNOUNCEMENT is made that Mead Johnson and Company has renewed the arrangements for a period of five years whereby the annual award of $1,000 will be given for research dealing with vitamin B complex. The recipient of this award will be chosen by a committee of judges of the American Institute of Nutrition.

IT is reported in *The New York Times* that trustees of the Wisconsin Alumni Research Foundation have decided to ask the Ninth Circuit Court of Appeals at San Francisco to re-study a ruling declaring that valuable patents covering the manufacture of Vitamin D are invalid. If the court does not reverse its ruling, the foundation will ask the United States Supreme Court for a review.

A CABLE to *The New York Times* states that according to Professor Eligio Ocana Vieto, first secretary to the Ministry of Education of Panama, the sum of $4,000 will be contributed monthly by the National Government of Panama for the organization and maintenance of an Inter-American University. This, it is said, will provide for five professorships and twenty scholarships offered by the Government to students of the American Continent. The university will be opened on September 27, coinciding with the opening of the Congress of the Ministers of Education of American Countries. The University of Notre Dame, Indiana, has offered to endow a chair in philosophy under a professor who would go to Panama every year.

THE daily press, quoting from an article in the Stockholm newspaper *Svenska Dagbladet*, states that the value of the Nobel Prizes in 1943 will be 123,690 kroner each ($30,922 at par). The value in 1942 was 131,891 kroner (about $32,972) each and, in 1941, 131,496 kroner (about $32,874).

DISCUSSION

CENSUS AREAS FOR THE UNITED STATES, 1940

FOR a decade Ex-Governor C. S. Osborn, of Michigan, and his daughter, Stellanova Osborn, have, with unbelievable endurance, pursued the Census Bureau, the Library of Congress, the Geological Survey, the General Land Office and even the American Geographical Society to have them "give back to Michigan" the water area of the adjoining Great Lakes which these agencies, one may be surprised to learn, never denied her. After much indecision the guilt for this deed finally has been fixed on the Census Bureau and, because SCIENCE chooses to publish the Osborn viewpoint, we wish to reply, although this brief statement does not do justice to the voluminous correspondence with the Osborns and their many staunch Michigan friends.

As might be expected, the Census Bureau and the principal map-making agencies of the Federal Government have not always been consistent in their manner of publishing State areas during the nearly one hundred years of the history of area measurement in the United States. The process has been evolutionary with the development of techniques, maps and needs. The areas published by the General Land Office during the second and third quarters of the nineteenth century excluded large water bodies such as the Great Lakes. Henry Gannett, geographer of the Census on loan from the Geological Survey, in 1881 published the first basic area measurements of the States and counties of the United States. He gave "gross areas" for the States and included the area of Chesapeake and Delaware Bays with the adjoining States but omitted all reference to the subdivision of that portion of the Great Lakes area under the jurisdiction of the United States. This manner of presentation was retained for each decennial census until 1906, when Gannett thought better of his omissions and listed, below his main table, the several States and the amount of Great Lakes water area "contained" by each. This method of presentation was retained by Gannett as well as by C. S. Sloane, who succeeded him as geographer of the Census, and Frank Bond, of the General Land Office, on those rare occasions when water areas were even published, until the current remeasurement for the Census of 1940.

It is incorrect to suppose that the latest remeasurement of the United States represents a slavish adherence to a traditional form of presentation. The presentation used was the outgrowth of extended discussion with professionally qualified cartographers, geographers, geodesists of the Federal map-making agencies and private scientific organizations. A special committee of the National Research Council gave consideration to this matter and a quotation from the report of this committee, dated May 3, 1941, is significant:

In the interest of keeping our statistics of area upon the basis usual in foreign countries it was concluded that the Great Lakes areas, Long Island Sound, Delaware Bay, Chesapeake Bay, Puget Sound, and the Straits of Juan de Fuca and Georgia, etc., should be excluded from the inland waters in the main table but presented in footnotes with the water areas of the several States.

The latest remeasurement of the United States represents a more basic departure from the past than the above decision might indicate. For the first time three fundamental definitions for land, inland water and water other than inland water were established. The application of these mutually exclusive definitions makes it possible for any one to duplicate the outer limits established for the United States and solves the vexatious problem, among others, of how to handle the hundreds of islands off the coasts of Maine and Florida. Finally, as facts that Mr. Osborn failed to note, not only does Map I, "Limits of the United States," contained in the Census publication "Areas of the United States: 1940," show that the current measurements were made to the International Boundary, but Table IV lists the Great Lakes area contained within each State. This gives full recognition to the fact that the Great Lakes to the International Boundary are under the legal jurisdiction of the United States and the adjoining States.

It is true, and properly so, that the Census Bureau is primarily a statistical agency. The funds which it spends are for collecting, analyzing and publishing statistics covering a wide range of subjects. The fact that Census areas have been vested with official, quasi-legal authority, over and above their service to statistics, is an evolution over which the Census Bureau has had no control. The U. S. General Land Office has the authority to make surveys and area determinations of a highly accurate legal character, based on actual field work. As for Census areas, at present they are as accurate as is feasible with national coverage on a map scale of 1:500,000, using geodetic tables for 30-minute quadrilaterals of latitude and longitude and careful planimeter measurements. Census areas will undergo revision each decade as improved, larger-scale maps are produced. It would be folly indeed if through the suggestion of Ex-Governor Osborn, Michigan should seek to legalize and constitutionally adopt a Census area for its State (with the Great Lakes area to the International Boundary included), when under the circumstances of measurement from the maps available, a gross error of one per cent. is to be expected, and future revisions are a certainty.

The areas to which Census statistics pertain are almost without exception land areas. The manner in which areas serve the census function is to enable users of statistical data to compute square mile densities for inter-area comparison. Small bodies of inland water too partake of a character analogous to land area from the statistical standpoint. But, in order not to be misleading statistically, it is considered appropriate to exclude large water bodies from inland water. For one thing, imagine the confusion of attempting to divide Lake Michigan among the adjoining counties of the four abutting States, and then to further subdivide this water among the minor civil divisions of these counties. Yet, if the distinction between "inland water" and "water other than inland water" (the Great Lakes and other large bodies of water) had not been made this procedure would have been required, no matter how ridiculously impracticable. Furthermore, it seems appropriate to avoid publishing areas in such a manner as to arouse a storm of legal and political controversy, yes, and manifestations of State patriotism! There is an American phobia for bigness. Michigan with her Great Lakes water area expands from 58,216 to 96,791 square miles; from the State listed as 21st in size to that of 9th in size; from the second largest State east of the Mississippi to by far the largest. These matters might seem trivial, but many a tempest has started in just such a teapot. Might not other States, Georgia, for instance, insist that the Census remeasure their areas and force the inclusion of coastal water areas to which they feel they have a legal claim. Where might this indoor sport lead? We believe the Census is right in avoiding such hair-splitting arduous labor. For those who do not believe that such controversies are latent, here are some of the facts and some of the fiction in the case:

California claims jurisdiction over all Pacific waters lying within 3 English miles of her coast; Oregon claims jurisdiction over a similar strip of the Pacific Ocean, one marine league in width between latitude 42° north and the mouth of the Columbia River; Texas claims jurisdiction over a strip of Gulf water 3 leagues in width, adjacent to her coast and between the Rio Grande and the Sabine River; the counties of New Jersey fronting upon the sea-coast extend, by statute, 3 nautical miles from the shore line; and Louisiana has passed legislation claiming a 27-mile limit. The remaining 16 states bordering the Pacific or Atlantic Oceans or the Gulf of Mexico either make varying claims or have entered no claims whatever to territorial waters. No certainty in international law exists relative to the limits of the territorial sea and there has been wide divergence of opinion. The United States, for fishing rights, uses a 3-mile limit and the revenue laws pushed the line for customs waters out to 4 leagues from the coast. During the prohibition era, jurisdiction was extended to a 12-mile limit and beyond, whereas now we are speaking of the limits of the Western Hemisphere. Russia claims a 12-mile limit, Italy a 6-mile limit, Norway and Sweden 4 marine miles and the United Kingdom 3 miles, and none of these powers agree on the manner in which their limits should be applied to the irregular shore line or embayments of their countries.

To be sure, some day these and all other problems of a kindred nature may be solved. But these are assignments for the Attorney General's Office, the Supreme Court and the State Department and are far afield for a statistical agency like the Census Bureau!

One further point needs clarification. It is true that the Canadian Census included the water area of the Great Lakes to the International Boundary in the total for the Province of Ontario. Canada is entitled to any manner of presentation which it may choose. However, the principal work of area measurement has been done in Europe and in the United States. Area measurement in Europe has not included the Caspian, Aral and White Seas, and the Sea of Azov in the total area of Russia; the various portions of the Baltic Sea have not been included within the total for Germany, Denmark, Sweden and Finland; the Sea of Marmara is not included in the total area of Turkey; and the Mediterranean and Black Seas are not treated as inland water, although their character certainly is inland or landlocked. T. Willers in *Petermanns Mitteilungen*, Ergänzungsheft Nr. 170, 1911, gives additional detail. The treatment of The Netherlands on page 1145 of the Statesman's Year-Book, 1940, is indicative of standard treatment.

C. E. BATSCHELET
M. J. PROUDFOOT

RIBOFLAVIN-VITAMIN B_2 IN SOIL[1]

LAST year while studying the occurrence of vitamins in fungi, on which a brief report was published in the June 16, 1942, issue of SCIENCE, the question was raised as to whether there was a possibility of finding vitamins in soil. Most of the molds studied, such as species of Aspergillus, Penicillium and Fusarium, gave positive tests for thiamin and riboflavin. Having cultured many soils in our mycology and soils laboratories and finding species of these genera in practically every culture, it seemed worth while to investigate whether soils contained vitamins. To date these investigations have been mostly confined to qualitative tests for vitamins B_2 or riboflavin.

Soil extracts were obtained by placing 25 grams of soil in a 250 ml Erlenmeyer flask, then adding 150 ml of 0.25 N sulfuric acid; this was attached to a digesting apparatus or autoclaved for an hour and the resulting solution decanted. All operations had to be carried on in a darkened room due to the fact that riboflavin breaks down in presence of light.

After the extract was obtained the following tests were applied to determine the presence of B_2-riboflavin.

(1) The method proposed by H. Kahler and E. P. Davis[2] where the B_2 is destroyed in solution by adding NaOH until a solution pH of 11 is reached. Our soil extracts, when adjusted by concentrating or diluting to read about 100 on the fluorophotometer and adding sufficient alkali to destroy the riboflavin, would drop to a reading of 30 to 40.

(2) The microbiological method used of determining riboflavin was outlined in the *Journal of the Association of Official Agricultural Chemists,* for May, 1941. Our *Lactobacillus casei* culture (Type 7469) was obtained from the America Type Culture Collection last summer. Quantitative tests were set up comparing the soil extracts with known amounts of riboflavin, and check sets without riboflavin. This biological method gave positive tests for this vitamin from many local soils.

From the work done at present, we believe that occurrence of B_2 is correlated with the amount of organic matter in the soil. Whether the vitamin comes from the breakdown of plant tissues or whether it is synthesized by fungi, or from both, remains to be determined.

The fact that vitamins are present in the soil does not mean that these vitamins are used in plant growth. We might have a system operating, comparable to the nitrogen cycle with its involved stages; also it seemed quite possible that plant roots might not be able to absorb the riboflavin molecule from the soil solution.

We decided to see if we could obtain any information regarding the question as to whether plant roots absorb the vitamin molecule. To do this, greenhouse plants from the species available were selected in pairs. The two plants used in each case were as nearly identical as possible. These were taken to the dark room and the tops removed, leaving stems about one half inch tall to which were attached pipettes by using rubber tubing long enough to make connections. One plant of each pair was watered with a 25,000 to 1 concentration of riboflavin and the other member of each pair was given distilled water. The root sap was collected in the pipettes and was tested by the *L. casei* biotest mentioned above for riboflavin. These results when subjected to statistical analysis agreed that the plant roots watered with riboflavin solution produced root sap that contained several times the riboflavin found in the root sap where distilled water was used.

---

[1] I gratefully acknowledge indebtedness to Edwin Schmidt and Beth Booth for assistance in carrying on various phases of these studies.

[2] H. Kahler and E. P. Davis, *Proc. Soc. Exp. Biol. Med.,* 44: 604, 1940.

The plants used for this determination were tomato, tobacco, fuchsia and carrots.

The studies made to date indicate that certain vitamins, particularly B_2 or riboflavin, are present in the soil and that some plants take up vitamins from this source as they absorb essential mineral elements.

If any of our crop plants supplement their synthesized vitamins with vitamins from the soil at different growth stages the presence or absence of vitamins in the soil immediately becomes a vital factor in crop production and soils management.

C. C. Carpenter

Department of Plant Science,
Syracuse University

APPARENT TIME ACCELERATION WITH AGE OF THE INDIVIDUAL

The apparent acceleration of time as one grows older seems a rather universal experience. All of us can recall what a long time a year used to seem when we were young children and how, as we grew older, the years seemed to pass faster. Even then, a year during our twenties was apparently a much longer space of time than a year in our forties, and as we approach sixty, a year seems much shorter still.

I have often heard questions raised as to the cause of this apparent acceleration of time with age. At one such discussion many years ago, I suggested that the reason might lie in that elapsed time as measured by the recollection of an individual seemed long or short according to what relationship it had to the individual's total time experience. For instance, at the age of eight, when our memory might go back over four years, a year would represent 25 per cent. of our total remembered time experience and hence seem like a very long time; at the age of twelve, memory may go back over eight years and one year would represent 12½ per cent. of total remembered time experience and could therefore appear to be only half as long as a year did at the age of eight. Similarly, at the age of fifteen, a year would be likely to represent only about 10 per cent. of remembered time and seem still shorter. At the age of 25 it would represent only about 5 per cent. of remembered time and hence seem only half as long as at the age of 15 and possibly one fifth as long as at the age of eight. At the age of 45 to 50, it would represent about 2½ per cent. of remembered time and at the age of 60 only 2 per cent. or less. Thus, as the years roll by, time would seem to be accelerating in speed. Off and on, since then, when such a matter would come up in conversation, I have offered this theory as a possible explanation of this experience, which I believe is quite general. Its reception by scientific friends has encouraged me finally to submit it for wider consideration.

F. W. Nitardy

SCIENTIFIC BOOKS

STRATIGRAPHY

Stratigraphy of the Eastern and Central United States. By Charles Schuchert. xvii + 1,013 pp. 4 plates. 123 figs. 78 correlation charts. New York: John Wiley and Sons, Inc. 1943. $15.00.

This encyclopedic work by the late Professor Charles Schuchert, of Yale University, is the second volume of three in the series bearing the general title, "Historical Geology of North America." The first volume, "Historical Geology of the Antillean-Caribbean Region, or the Lands Bordering the Gulf of Mexico and the Caribbean Sea," was published in 1935. The third volume, dealing with the stratigraphy of Greater Acadia, eastern, central and Arctic Canada, the Arctic Archipelago and Greenland, was in essentially complete typescript at the time of Professor Schuchert's death and will be published in due time.

Together, the three volumes are designed to document an "Atlas of American Paleogeography," which is to be issued as a part of volume three in the series. They are the product of almost forty years of painstaking examination and correlation of published geological studies supplemented by years of careful field work, particularly within the areas involved in the present volume.

Following a concise and valuable introductory chapter on "Stratigraphic and Time Terms and their Grouping," this volume is divided into eight parts, as follows:

"Part I. The New York Standard." This discussion includes the Paleozoic formations of the State except the "much deformed and much metamorphosed Cambro-Ordovician area of the Taconic Mountains of the Hudson-Champlain valleys." This region is considered to be "in reality . . . but the western margin of Greater Acadia" and will be described in volume III.

"Part II. The States Athwart the Appalachian Geosyncline." Following an introductory statement on the Appalachian geosyncline, the discussion includes the Paleozoic and, generally, the Lower Mesozoic sequences of Pennsylvania, New Jersey, Maryland, Virginia, West Virginia, eastern Tennessee, North and South Carolina, Georgia, Alabama and Mississippi.

"Part III. The Atlantic Coastal Plain." Completing the examination of the eastern states, this area is divided into three subregions: the northeastern, the middle and the southeastern Atlantic Coastal Plain.

"Part IV. The States Athwart the Cincinnati Anticline." Included here are Central and West Tennessee, Kentucky, Ohio, Indiana and Michigan.

"Part V. The States Around the Ozark Dome." Illinois, Missouri and Iowa.

"Part VI. The States of the Upper Mississippi Valley." Minnesota and Wisconsin.

"Part VII. The Eastern Plains States." North Dakota, South Dakota, Nebraska and Kansas.

"Part VIII. The States to the North and West of the Borderland Llanoria." A general introduction describes and discusses the "Late Paleozoic Oklahoma Mountains of the Llanorian Geosyncline." This is followed by the description of the stratigraphy of Arkansas, Oklahoma and Texas.

Except for Part III the chapters in each part are concerned with the geology of a separate state. In general, each chapter begins with a short history of the early geologic work in the state, followed by a synopsis of the physiography and structure of the area. The major portion is, however, devoted to a highly condensed description of the various formations, and their members are listed together with notes on their general lithology, thickness, important faunal contents and correlation, all being completely documented with bibliographic references. Thus, in contrast to the more narrative style of the first volume of the series, the present has of necessity become almost "telegraphic" in style and is essentially almost an encyclopedia of the stratigraphy of the region covered. It will prove an invaluable tool to the stratigrapher, wherein he can at once find the essential data regarding any formation but from which he will be led, as was clearly intended by the author, to consult the original works for more detailed information.

The three volumes of this series will form Professor Schuchert's most enduring monument. They are a lasting tribute to the insight, organizational ability and untiring energy of a great scientist.

H. E. VOKES

MINERALS AND ROCKS

Minerals and Rocks—Their Nature, Occurrence and Uses. By RUSSELL D. GEORGE. xviii + 595 pp. 68 plates. 150 figs. New York: D. Appleton-Century Company, Inc. 1943. $6.00.

IN this book Dr. George has done an excellent job of bringing together and co-ordinating material from several branches of the geological sciences. It is written especially for use as a textbook in economic mineralogy, and might be considered a reference book on that subject. Because of its broad scope, considerable material useful to a beginner in mineralogy or petrology has necessarily been omitted.

The physical properties of minerals, crystallography and the origin and form of ore deposits are considered in two introductory chapters. Parts I, II and III (Part I, "Metallic Elements and Minerals"; Part II, "Non-Metallic Elements and Minerals"; Part III, "Rock-Making Minerals"), which make up the main portion of the book are devoted principally to the description of mineral species. The minerals are grouped, in general, according to the most important economic element which each contains. Such a classification is, no doubt, desirable in this book, but it has its attendant disadvantages, for it is difficult to pigeonhole many minerals in such a manner. Thus, pyrite and arsenopyrite are considered under iron, although the former is chiefly an ore of sulfur, while the latter is principally an ore of arsenic. Although dolomite is appropriately described under sedimentary rock minerals, it might equally well be considered under ores of magnesium. Before giving the individual descriptions of the minerals brought together under the heading of a common element, a brief account is given of the element itself, its uses, sources and production. These paragraphs contain much valuable information and are particularly instructive.

Part IV, "Determinative Mineralogy," briefly describes blowpipe tests and equipment, lists tests for most of the elements, and includes tables of minerals grouped according to color and luster.

Part V, "The Common Rocks," considers the origin, description and classification of the igneous, sedimentary and metamorphic rocks. The last chapter on "Industrial Uses of Rocks" gives much valuable and interesting material not usually included in books on petrology.

C. S. HURLBUT, JR.

HARVARD UNIVERSITY

QUALITATIVE ANALYSIS

The Theory and Practice of Semimicro Qualitative Analysis. By G. B. HEISIG. xiii + 331 pp. 15 figs. 14 × 21 cm. Philadelphia and London: W. B. Saunders Company. 1943. $2.50.

To the already long list of available texts in qualitative analysis, Professor Heisig has added another which must be justified mainly on the basis of its extensive treatment of the anions, and a thoroughly modern approach to the theoretical matters underlying the practical work. The book is designed for students who have already had a college course in general inorganic chemistry, and follows a strictly semimicro procedure. Very small samples are used (1 mg or 4 drops of unknown solution) and provision is made for filtering by the pressure-bulb method of Barber, as well as for centrifuging.

The theoretical section takes up about one third of the book. This includes modern concepts of complete ionization, acid-base relationships, etc., which are made an integral part of the later discussions in the experimental sections. Especially noteworthy are the up-to-date sections on hydrolysis and amphoterism, the author's treatment of "ammonium hydroxide" as ammonia, and the inclusion of a separate chapter dealing with the concept of activity. To this reviewer, the entire theoretical section, although admirable in its scope, was somewhat lacking in general clarity and readability. There might be mentioned, as contributing to this, rather poor arrangement of the topics discussed and occasional misplaced emphasis. Thus more space is devoted to the nomenclature of Werner compounds than is given to an explanation of their structure.

In the experimental section which follows, 100 pages are devoted to the 24 common cations. General discussion of the chemistry of the several metals and preliminary experiments on the reactions of their ions precede the actual group analysis. The latter follows customary procedure, employing sodium hydrogen sulfide to separate the copper and tin subgroups, and making use of only the most essential organic reagents. A good discussion of the analysis of each cation group follows the description of the procedure. It is unfortunate that a complete summary of the several cation groups is to be found nowhere in the section on cations, but only in the Introduction, and that here the sulfides of Group II are described as "sparingly soluble in water," while those of Group III are said to be "almost insoluble in water."

To the analysis of 24 anions the author devotes 72 pages. The selection is somewhat arbitrary, including for example chlorate, bromate, iodate and perchlorate, but excluding silicate, arsenite, acetate and oxalate. The procedure followed is that of Sneed and Duschak[1] adapted for semimicro use by the author and A. Lerner. It has the advantage of dividing the anions into five mutually exclusive groups, which are separated in order by means of successive precipitations of the calcium, barium, cadmium and silver salts under proper conditions. Without first-hand experience of the method, this reviewer can not form an adequate opinion of its merits.

The Appendix of 21 pages contains several valuable features, including a good review of mathematical operations used in qualitative analysis, and an exhaustive but uncritical list of reference books in qualitative analysis and inorganic chemistry.

This first edition of Professor Heisig's book is marred by numerous small errors and omissions. Misspellings, especially of proper names, are frequent; it is to be hoped that these will be corrected subsequently.

WENDELL H. TAYLOR

DISEASES OF DOMESTIC ANIMALS

The Infectious Diseases of Domestic Animals. By WILLIAM ARTHUR HAGAN, D.V.M., D.Sc., professor of bacteriology and dean of the faculty, New York State Veterinary College, Cornell University. 665 pp. 145 ill. Ithaca, N. Y.: Comstock Publishing Co., 1943. Price, $6.00.

THIS is a well-integrated and entirely adequate account of the host of infectious diseases to which domesticated mammals and birds are subject, of the specific microorganisms involved and of available methods of diagnosis and control. The introductory section of the book is a consideration of the general aspects of infection and disease production by microorganisms, and of the nature and development of the immune response, with a brief review of allergic conditions and of iso-antibodies. Discussion of groups of microorganisms is arranged under the following section headings: Pathogenic Bacteria, Bacteria-like Pathogenic Organisms of Uncertain Classification, *i.e.*, Spirochetes, Rickettsiae and Pleuropneumonia Group, Pathogenic Fungi, Pathogenic Protozoa and Viruses. For each of these groups or, where justified, for individual organisms, consideration follows the general pattern: morphology, reactions in culture, natural habitat, pathogenicity and types of disease in susceptible hosts, diagnostic and control methods, immune response, and, where appropriate, relation to disease of man. These divisions of the subject matter are clearly marked by subtitles in bold face type, giving ready access to any part of the material. To each chapter and to many chapter subdivisions short lists of well-chosen references are appended. This is not a textbook of bacteriology in the usual sense. Instead, its purpose is much broader, and it presents a well-balanced treatment of the important aspects of infectious diseases of lower animals.

HERBERT L. RATCLIFFE

---

[1] *Jour. Chem. Ed.*, 8: 1177–86 and 1386–95, 1931.

SPECIAL ARTICLES

OBSERVATIONS CONCERNING THE ETIOLOGY OF PRIMARY ATYPICAL PNEUMONIA

THE clinical syndrome currently known as primary atypical pneumonia may be caused occasionally by viruses of the psittacosis group[1,2,3,4,5] or by Rickettsiae,[6] but in the great majority of cases it is apparent that some other agent is responsible. Within recent months a number of investigators have reported attempts to isolate and identify this agent, which is presumably a virus.[7,8,9,10,11]

---

[1] M. D. Eaton, M. D. Beck and H. E. Pearson, *Jour. Exper. Med.*, 73: 641, 1941.

Eleven patients severely ill with primary atypical pneumonia were selected for the present study. Sputum, throat washings and blood from nine of these cases were inoculated to animals and birds by several routes, and serial passages were carried out. Specimens of lung and spleen were utilized in a similar manner from the remaining two cases, both of whom died of other causes while the pulmonary infection was present. No gross or microscopic evidence of disease was observed in any of the following species, either after primary inoculation, or after serial blind passage: ferrets, Swiss mice, deer mice, Syrian hamsters, rabbits, white rats (normal, x-rayed, adrenalectomized, splenectomized), cotton rats, rice birds, pigeons.

However, in recently weaned guinea pigs 10 strains of a readily transmissible agent have been isolated from 7 of the 11 patients, as indicated in Table 1.

TABLE 1

Case	Age and sex	Source of strains	Day of disease isolated
J. A.	M 22	Sputum	5
		Blood	4
B. W.	F 22	Throat washings	4
		Sputum	11
D. K.	M 55	Lung	9
		Spleen	9
E. V.	F 24	Sputum	10
B. R.	F 26	Sputum	12
E. L.	F 55	Lung	13
L. F.	M 24	Throat washings	10

Pulmonary lesions appeared in the animals on first passage with two strains, on second passage with two strains, on third passage with five strains and on fourth passage with the remaining strain. The agent produces a disseminated bronchopneumonia which becomes manifest grossly in from 12 to 20 days and shows complete resolution after 45 to 60 days. Successful transmission has been accomplished only by the intranasal route of inoculation. The infective titer is low, usually 10^{-2}, although in one instance a titer of 10^{-4} has been observed.

The various strains have now been carried through from 3 to 16 passages, employing a total of 387 guinea pigs, with no demonstrable alteration in character of the pulmonary disease, and no increase in virulence of the agent. In 90 control guinea pigs the intranasal inoculation of suspensions of normal guinea pig lung, with 3 to 5 subsequent passages, has invariably given negative results.

The agent will pass through a Berkefeld V candle but is retained by filters of smaller porosity. It is unstable and deteriorates rapidly in saline suspensions at both room and ice-box temperatures, but may be protected by broth or normal serum. Potency is maintained for at least 6 months in the frozen state.

Pathologically the pneumonia in the guinea pig is characterized by thickening of the alveolar septa due to congestion and infiltration with mononuclear cells, scanty collections of monocytes in the alveoli and lymphocytic cuffing about the blood vessels and bronchi. Bronchitis is slight or absent. Inclusion bodies, elementary bodies and Rickettsia-like organisms have not been observed. Routine cultures of the lungs on blood agar under CO_2, and at intervals on other media to reveal the presence of anaerobes or organisms of the pleuropneumonia group, at no time have revealed bacteria that could be considered responsible for the disease.

Identity of the various guinea pig strains has been demonstrated by cross-protection tests, recovered animals showing immunity to reinfection with both homologous and heterologous strains. However, pooled convalescent guinea pig sera and sera from immunized rabbits have failed uniformly to neutralize the agent by any of several techniques employed. Neutralization tests with acute and convalescent sera from cases of atypical pneumonia have likewise been unsuccessful. Complement fixation tests with patients' sera proved to be impractical, since we encountered nonspecific fixation with normal tissue antigens.[12]

Attempts to cultivate the agent in the developing hen's egg and in various types of tissue cultures have thus far given negative results.

Although we have been unable to produce pulmonary lesions in the cotton rat by the inoculation of human material, a bronchopneumonia has been regularly produced in this animal following intranasal inoculation of all strains of the guinea pig agent. The incubation period in the cotton rat aver-

---

[2] K. F. Meyer, *Medicine*, 21: 175, 1942.

[3] J. M. Stickney and F. R. Heilman, *Proc. Staff Meet. Mayo Clin.*, 17: 369, 1942.

[4] J. E. Smadel, *Jour. Clin. Invest.*, 22: 57, 1943.

[5] C. B. Favour, *Am. Jour. Med. Sci.*, 205: 162, 1943.

[6] R. E. Dyer, N. H. Topping and I. A. Bengtson, *Pub. Health Rep.*, 55: 1945, 1940.

[7] J. A. Baker, SCIENCE, 96: 475, 1942.

[8] M. D. Eaton, G. Meiklejohn, W. Van Herick and J. C. Talbot, SCIENCE, 96: 518, 1942.

[9] F. G. Blake, M. E. Howard and H. Tatlock, *Yale Jour. Biol. and Med.*, 15: 139, 1942.

[10] J. H. Dingle *et al.*, *War Med.*, 3: 223, 1943.

[11] F. L. Horsfall, Jr., E. C. Curnen, G. S. Mirick, L. Thomas and J. E. Ziegler, Jr., SCIENCE, 97: 289, 1943.

[12] L. Thomas, E. C. Curnen, G. S. Mirick, J. E. Ziegler, Jr., and F. L. Horsfall, Jr., *Proc. Soc. Exper. Biol. and Med.*, 52: 121, 1943.

ages one week. Pulmonary involvement is often extensive, but the animals rarely die. On section the lungs of infected cotton rats show an alveolar exudate rich in polymorphonuclear neutrophiles. Bronchitis is frequently observed. The picture suggests a bronchopneumonia caused by bacteria, but cultures have regularly failed to reveal significant microorganisms. Moreover, the agent is transmissible after filtration through a Berkefeld V candle, as in the guinea pig.

Selected cotton rat strains have been carried through 12 to 19 passages, employing a total of 334 animals. In 47 control cotton rats no pulmonary lesions have been observed, following the intranasal inoculation and subsequent passage of normal lung suspensions.

The cotton rat strains have been shown to be antigenically similar to one another by cross-protection tests. Furthermore, recovered cotton rats are immune to reinoculation with homologous and heterologous strains of the guinea pig agent, thus demonstrating that the agents in the cotton rat are identical with the original guinea pig strains.

Neutralization and complement fixation tests with the cotton rat strains, employing sera from patients, convalescent rats, convalescent guinea pigs and immunized rabbits, have given inconclusive results.

However, both guinea pigs and cotton rats repeatedly injected by the intranasal route with human material, including sputum, throat washings, lung and spleen, develop a partial or complete immunity to infection with passage strains of the agent from either the guinea pig or the cotton rat.

HARRY M. ROSE
ELEANORA MOLLOY
DEPARTMENTS OF MEDICINE AND OF BACTERIOLOGY,
COLLEGE OF PHYSICIANS AND SURGEONS,
COLUMBIA UNIVERSITY

LOSS OF PROPRIOCEPTIVE REFLEXES FOLLOWING RETROGRADE DEGENERATION[1]

ACHESON, Leo and Morrison[2] have reported a decrease in spontaneous respiratory activity in the cut phrenic nerve during the period of retrograde degeneration. To check the nature of this deficiency and to define it in terms of spinal reflexes a study was made of a series of cats in which the sciatic nerve had been cut. Stimuli were delivered as single shocks to the peripheral nerves or to the dorsal roots, and recordings were made from the dorsal and ventral roots with a cathode ray oscillograph.

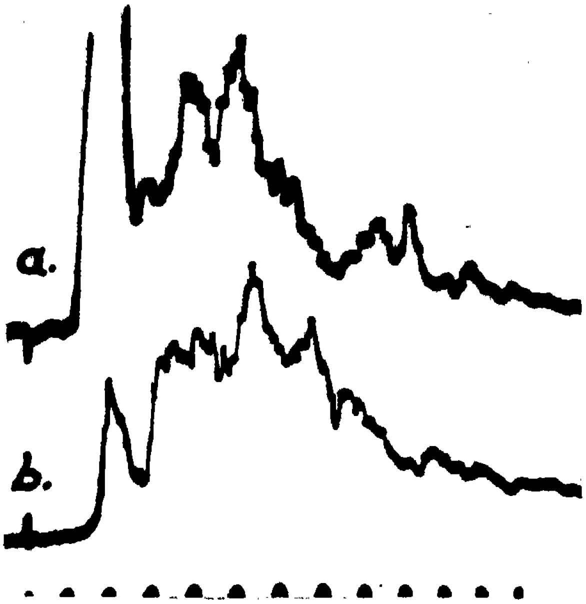


FIG. 1. Potentials recorded from 7th lumbar ventral root in a cat which had had the right sciatic nerve cut 12 days previously. The stimulus was in each case a single condenser discharge to the dorsal root. (*a*) Left side. (*b*) Right side. Time intervals, 1 millisecond.

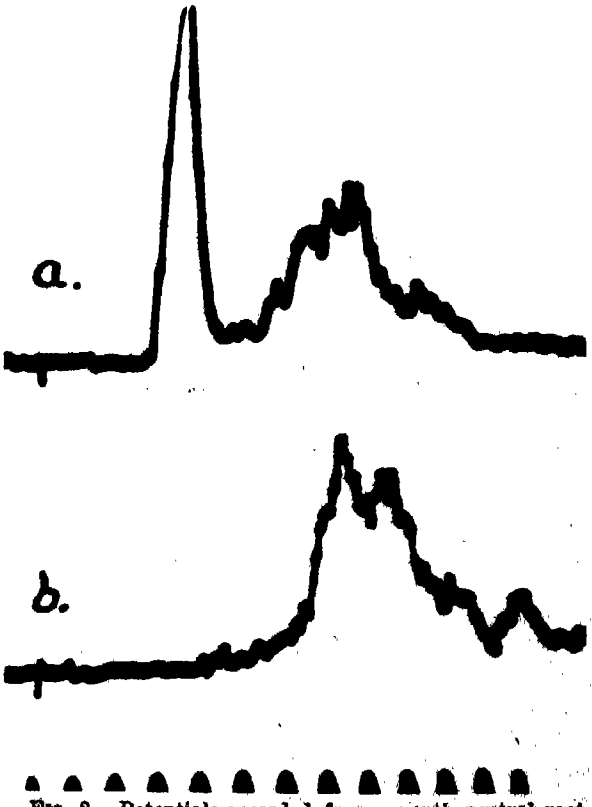


FIG. 2. Potentials recorded from seventh ventral root of same preparation in response to stimulation of the central ends of the cut sciatic nerves. The conduction distances on the two sides were approximately equal. (*a*) Left side. (*b*) Right side. Time intervals, 1 millisecond.

---

[1] From the Department of Neurology, College of Physicians and Surgeons, Columbia University. Aided by a grant from the National Foundation for Infantile Paralysis.

[2] G. H. Acheson, E. S. Lee and R. S. Morrison, *Jour. Neurophysiol.*, 5: 269, 1942.

Records of the dorsal-ventral root reflexes allow differentiation of the proprioceptive or myotatic reflexes (the 2 neuron reflex of Renshaw,[3] and Lloyd,[4]) and the flexor or cutaneous reflex. Fig. 1*a* illustrates the normal record from the 7th lumbar ventral root, following stimulation of the corresponding dorsal root, of these reflexes on the control side of a cat in which the peroneal, tibial and hamstring nerves had been unilaterally sectioned 12 days previously. The high initial spike represents the proprioceptive reflex, the slower later activity the flexor response. Fig. 1*b* illustrates the alteration found on the degenerated side. Note the small proprioceptive component which must be ascribed to the activity of the undegenerated nuclei of the gluteal and other hip muscles. Fig. 2*a* shows the response in the 7th lumbar ventral root of the same preparation following stimulation of the normal sciatic nerve at the level of the greater trochanter. The separation of the proprioceptive and the flexor reflexes is well marked. On the degenerated side, when the sciatic nerve was stimulated at a comparable level, the proprioceptive reflex was absent, though the flexor response was essentially unaltered. Histological check revealed extensive chromatolysis of ventral horn cells had followed the nerve section.

This effect has been found in all cats allowed to degenerate after section of the sciatic nerve over a period of from 10 to 27 days. Records were made on the 10th, 11th, 12th, 14th, 18th, 20th and 27th postoperative days. Further studies are in progress to determine the early time course of the phenomenon and to resolve the mechanism by which the deficiency is related to chromatolysis.

Summary. Section of peripheral nerves in cats leads to the loss of the ventral root potentials homologous with the proprioceptive reflex during the period of retrograde degeneration. The corresponding potentials of the flexor reflex are essentially unchanged.

Berry Campbell

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN IMPROVED INSTRUMENT FOR MEASURING CAPILLARY FRAGILITY

In a study of the effects of substances on the resistance of the capillary wall, Dalldorf's modification[1] of the Da Silva-Mello technique was used. Considerable difficulty, however, was experienced in visualizing the field and recognizing the appearance of petechia. The modification to be described here largely overcomes this difficulty.

The fragility of the vessels of the skin is determined by estimating their resistance to negative pressure. The apparatus as used by Dalldorf consists of a mercury manometer connected to a small cylinder approximately one centimeter in diameter and one and a half centimeters in length. One end is sealed with a glass window, while the open end is placed over the skin area. In order to obtain airtight contact with the skin and at the same time not exert undue pressure, a flat rim is attached to the open end. By means of rubber tubing the manometer and cylinder is attached to a vacuum pump. With the cylinder placed on the skin, the minimum decompression at which petechia are formed in one minute is taken as the end point.

Our modification (Fig. 1) consists in changing the small end of one speculum of an electric pneumatic otoscope into the shape of the lower end of the above described cylinder and using the otoscope with its lens system in place of the cylinder and the plain glass window. In order to convert the standard otoscope for use in this work, it is only necessary to modify one of the specula. This is cut off at a point at which its diameter is approximately one cm and the small end replaced with a washer one and one half cm in diameter. When made smooth, this washer forms the surface to be applied to the skin. The tube branching from the side of the head of the otoscope is connected to the manometer and the vacuum pump by means of a piece of rubber tubing. The convex lens and small bright light make the petechia easily recognized. If a small portable

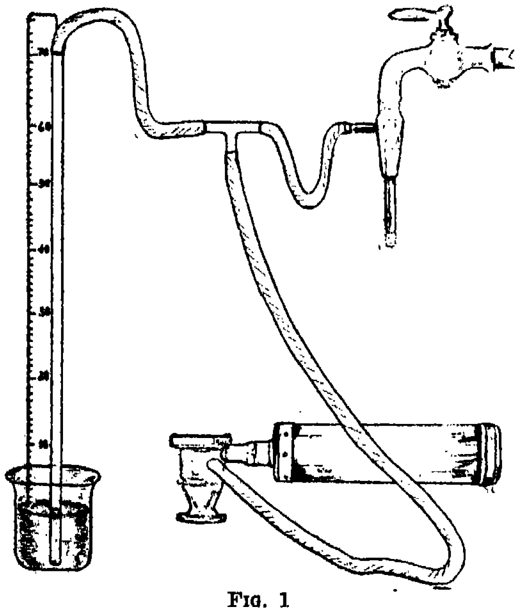


Fig. 1

---

[3] B. Renshaw, *Jour. Neurophysiol.*, 3: 373, 1940.

[4] D. C. P. Lloyd, *Jour. Neurophysiol.*, 6: 111, 1943.

[1] *Jour. Exp. Med.*, 53: 289, 1931.

vacuum pump powered with an electric motor is available to produce the decompression the apparatus can be used on the hospital wards for clinical investigation. If used in the laboratory for animal experimentation a filter pump, as shown in the figure, connected to the water line will be found quite satisfactory. A small vacuum tank may be included in the system to take care of any changes in pressure due to pressure changes in the water line.

R. A. WAUD
H. G. SKINNER
DEPARTMENT OF PHARMACOLOGY,
UNIVERSITY OF WESTERN ONTARIO
MEDICAL SCHOOL

A SIMPLIFIED ALL-PURPOSE GRAVITY WRITING LEVER

SINCE describing an inexpensive gravity writing lever for respiratory tambours[1] we have simplified and extended the usefulness of the apparatus. The principle of a carrier holding a writing arm in such a manner that gravity will cause this arm to contact the drum is the same as previously described. The difference is that the carrier has been made smaller and lighter in weight and thus applicable to heart and muscle levers. The simplified carrier is made from the ordinary aluminum writing arm wire. It is illustrated in the figure and is easily made as follows:

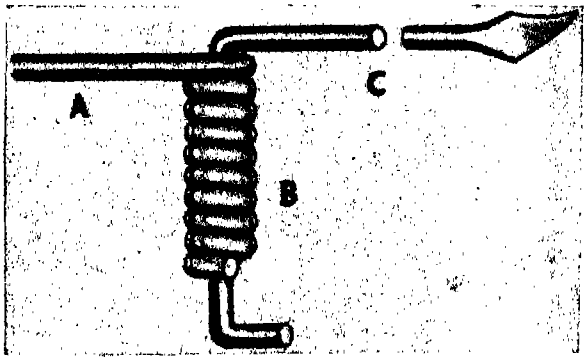


FIG. 1.

A close spiral about one-half inch in length is wound at one end of a four- or five-inch piece of the wire. The spiral is then bent at a right angle to the rest of the wire (A). About three-fourths inch of a second wire (C) is bent to nearly a right angle. The short arm of this right angle is inserted longitudinally through the spiral and its protruding end bent to hold it in place. Joined in this fashion the spiral and the short arm of the second wire make a hinge (B) which permits the long arm of the wire (C) to act with gravity and fall against the drum. The straight arm of the first wire (A) is inserted in the spindle in the usual manner. The sensitivity of the lever may be varied by the amount of tilt given the hinge (B) and by changes in the weight and length of the second wire (C). This lever is as satisfactory as many complicated models now on the market and can be made by students in a few minutes from their old levers.

H. R. HULPIEU
INDIANA UNIVERSITY SCHOOL OF MEDICINE,
INDIANAPOLIS

A SIMPLE TIMING DEVICE FOR SPEAKERS

EVERY one attending conventions, such as those of our scientific associations, has been impressed by the necessity of controlling the time used by the speakers on crowded programs. One speaker running much over the 12, 15 or 30 minutes of time allotted to him may considerably disrupt a morning or afternoon program. The chairman naturally hesitates out of courtesy to the speaker brusquely to interrupt him and may merely announce "Time" or sharply tap with a pencil when his time is up. This introduces a personal element which may be irritating to some.

While presiding over the recent meetings of the North Dakota Academy of Science I used a photographic interval timer clock which several speakers afterwards commended. The speakers were allotted 15 minutes and I announced several times that the clock would be set to "tinkle" at 13 minutes, allowing two minutes to finish. When the speaker commenced to talk the clock was set and was thereafter ignored. No further personal element was interjected and the alarm went off impersonally for all. The "tinkle" was subdued by placing the clock under a hat.

NEAL A. WEBER
UNIVERSITY OF NORTH DAKOTA

BOOKS RECEIVED

FALES, HAROLD A. and FREDERIC KENNY. *Inorganic Qualitative Analysis.* Illustrated. Pp. ix + 237. D. Appleton-Century. $2.65.

HAYS, F. A. and G. T. KLEIN. *Poultry Breeding Applied.* Illustrated. Pp. 192. Poultry-Dairy Publishing Co.

HEALD, FREDERICK D. *Introduction to Plant Pathology.* Illustrated. Pp. xii + 603. McGraw-Hill Book Co. $4.00.

JEAN, FRANK CONVERT and OTHERS. *Man and His Physical Universe.* Illustrated. Pp. viii + 607. Ginn and Company. $3.25.

LINDSAY, ROBERT BRUCE. *Handbook of Elementary Physics.* Illustrated. Pp. xv + 382. The Dryden Press. $2.25.

RUPPERT, KARL and JOHN H. DENISON, JR. *Archaeological Reconnaissance in Campeche, Quintana Roo, and Peten.* Illustrated. Pp. vii + 156. Carnegie Institution of Washington. $4.25, paper cover; $4.75, cloth binding.

SCHMIDT, CARL L. A. *Addendum to the Chemistry of the Amino Acids and Proteins.* Illustrated. Pp. xii + 1290. Charles C Thomas. $5.00.

SHERMAN, HENRY C. *The Science of Nutrition.* Pp. x + 253. Columbia University Press. $2.75.

STILES, KARL A. *Laboratory Explorations in General Zoology.* Illustrated. Pp. x + 265. Macmillan. $2.50.

WINSLOW, CHARLES-EDWARD A. *The Conquest of Epidemic Disease.* Pp. xii + 411. Princeton University. $4.50.

---

[1] SCIENCE, 96: 590, 1942.

SCIENCE

VOL. 98 FRIDAY, AUGUST 6, 1943 No. 2536

Fisheries Research in Canada: DR. A. G. HUNTSMAN 117

Internationalism in Science: DR. KARL K. DARROW 122

Obituary:
Frank Schlesinger: DR. HENRY NORRIS RUSSELL. *Arthur Willis Goodspeed:* PROFESSOR HORACE C. RICHARDS. *Recent Deaths* 123

Scientific Events:
The Death-Rate in Germany; United States Lecturers in Brazil; The Proposed Oceanarium at Coney Island; The Study of Germicides and Bactericides at the Ohio State University; Work of the National Foundation for Infantile Paralysis; The Library of Sir Isaac Newton 126

Scientific Notes and News 129

Discussion:
The Digestion of Living Tissues by Proteolytic Enzymes: DR. CARL A. DRAGSTEDT. *Vitamin C in Evergreen-tree Needles:* DR. MAURICE DONNELLY. *Transliteration of Russian Names:* PFC. DAVID G. NICHOLS and PROFESSOR R. M. STRONG 131

Scientific Books:
Mathematics: PROFESSOR PHILIP FRANKLIN. *Photographic Reproduction:* JAMES STOKLEY 133

The American Association for the Advancement of Science:
Resolution of the Council on the Science Mobilization Bill 135

Special Articles:
Enhancement of Leukemogenic Action of Methylcholanthrene by Pre-Irradiation with X-Rays: DR. J. FURTH and M. C. BOON. *The Comparative Nutritive Value of Butter and Some Vegetable Fats:* DR. HARRY J. DEUEL, JR., ELI MOVITT and LOIS F. HALLMAN 138

Scientific Apparatus and Laboratory Methods:
A Simple and Efficient Calomel Half Cell: DR. F. L. HAHN 140

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

FISHERIES RESEARCH IN CANADA

By Dr. A. G. HUNTSMAN

UNIVERSITY OF TORONTO

IN fisheries research as in many other things Canada through her intermediate position is powerfully influenced by both Great Britain and the United States, but their differences have permitted her to "call her soul her own" and to follow a somewhat independent course. Her organization for fisheries research did not spring like Minerva "full-armored from the head of Jove," the creation of some master or collective mind, as have many research organizations, but has developed like an organism, in relation to its environment and by learning from experience.

After the forced union of Upper and Lower Canada (Ontario and Quebec) in 1841, the new Province of Canada felt the stimulus of opportunity for self-government. With demands for protection of its fishing population along the shores of the Gulf of St. Lawrence from inroads of fishermen from the colonies of New Brunswick and Nova Scotia and from the New England states, it considered the services of a British cruiser inadequate and in 1852 appointed Pierre Fortin, a graduate in medicine of McGill University and in later life a Member of Parliament, as magistrate in command of the expedition for the protection of the fisheries in the Gulf of St. Lawrence, building the armed schooner *La Canadienne* for his use. He was not only magistrate, but also counselor and physician to the scattered communities along the coast, and in addition initiated fisheries research. He described the fishes (naming a new species) as well as the fisheries, and developed a system of detailed fishery statistics that was adopted for the rest of Canada and that has given this country these basic data for fishery research, collected in more detail and continuously for a longer period than holds for any other country. On confederation of the province with New Brunswick and Nova Scotia to form the Dominion of Canada in

1867, a Department of Marine and Fisheries was formed and recently there has been a Department and a Minister of Fisheries to represent this relatively important field in the counsels of the Cabinet.

In spite of keen desire by those in authority for more knowledge, fisheries research did not develop in the uncongenial atmosphere of administration, where, under pressing need for immediate action, the best thinking ability that is available is preempted for making wise decision with the knowledge at hand. However, the department assisted the sponge specialist, J. F. Whiteaves, to dredge in the Gulf of St. Lawrence in the seventies, which resulted in his "Marine Invertebrates of Eastern Canada." Also it employed the naturalist and geologist, H. Y. Hind, to prepare its case before the Halifax Commission of 1877 in Canada's controversy with the United States over fishing rights, and he produced a noteworthy but little known presentation of available oceanographic knowledge of Canadian Atlantic waters on the causation of the fisheries.

Other forces were at work. Rapid increase in the population of the continent produced the illusion of diminishing natural resources, there being an actual decrease in the amount per person. This illusion was fortified (1) by the undoubted disappearance of certain animals, as in fisheries the early extermination of walrus in the Gulf of St. Lawrence, and (2) by emphasizing each drop in abundance of valuable species in long-term fluctuations of still unknown origin. This brought about the establishment of a federal fishery service in the United States with the appointment of Spencer Baird of the Smithsonian Institution as Commissioner of Fish and Fisheries in 1871. The largely illusory decrease of fishes was already being seen as having a remedy, which has proved equally illusory. Artificial hatching and planting of fry originated in Europe and developed simultaneously and rapidly in both Canada and the United States, giving extensive governmental fish cultural services and bringing into existence in 1870 what is now the American Fisheries Society.

It was, therefore, natural that Canada, in appointing a scientist as Commissioner of Fisheries in 1893, selected a specialist in fish embryology, E. E. Prince, a native of Leeds, England, who had a background of experience at the Gatty Marine Laboratory in Scotland under the zoologist, W. C. McIntosh, of St. Andrews University. The new appointee immediately advocated an idea already prevalent in Canadian academic circles that there should be a marine biological station for fishery research. The idea took definite shape at a meeting of the British Association for the Advancement of Science at Toronto in 1897, and with a grant from the Government the Marine Biological Station of Canada came into being in 1899 at St. Andrews, New Brunswick. Its board of management consisted of university representatives who wished summer facilities for themselves, their colleagues and their students to make contributions to knowledge that would be of value for the fisheries.

The station, with a movable laboratory, transported on a scow, tried in successive two-year periods five different sites along the coast, ending at Seven Islands on the north shore of the St. Lawrence but without the laboratory, which had suffered shipwreck. It was then permanently established in 1908 at St. Andrews as the Atlantic Biological Station. By this time there was on the Great Lakes the Georgian Bay Biological Station, established in 1901 under the curatorship of B. A. Bensley, of the University of Toronto, and, in British Columbia, the Pacific Biological Station, established near Nanaimo in 1907 under the curatorship of the Reverend G. W. Taylor, a retired Anglican clergyman, who had followed an English tradition of using leisure time to advance knowledge of systematic zoology.

The managing body was now a board of directors, of which one, the secretary, D. P. Penhallow, botanist of McGill University, directed the development of the new station at St. Andrews forcefully. But need for direction of work towards definite objectives conflicts with the freedom so necessary for the most fundamental research. After an enthusiastic start, the work quickly declined but was redeveloped with steady progress under curatorship. Under control of the board's finances by the department, a clerk's veto of a request for purchase of scientific literature because the latter was in foreign languages caused an explosion and resulted in the creation in 1912 by Act of Parliament of the Biological Board of Canada, an independent body under the minister to have charge of all biological stations.

Under the stimulus of the Great War, the secretary of the board, the biochemist, A. B. Macallum, of Toronto, fostered work at the St. Andrews Station, starting in 1915, on the biochemistry, bacteriology and handling of fresh and cured fish. As the first chairman of the Canadian Research Council, established in 1916, he favored the development of such work in a central institute under the council, the course taken in Great Britain. Then the Department of Fisheries, arguing that the board as a volunteer organization could not be expected to undertake all the necessary fisheries research, attempted in 1920 through parliamentary action to develop a scientific division for the purpose, which would have put fisheries research of all kinds under administration as it is in the United States. Macallum blocked this, but it cost him his membership on the board.

There have been full-time curators at both Atlantic and Pacific Stations from 1916 on and, on being made directors in 1919, they were to an increasing extent active in developing the work. Attack on practical problems was encouraged by A. P. Knight, biologist of Queen's University, made chairman in 1920 and a member from the beginning, who had taken the first formal step toward creation of the board by a letter to the Royal Society of Canada in 1895. He had himself been studying pollution, bait, effectiveness of lobster culture and conditions in lobster factories in cooperation with the department. Inquiry in 1922 revealed that the fishing industry was for the most part untouched by what the board had done or even frankly sceptical of its having any value. In 1923, in order to bring the work definitely into relation with practice, non-scientists were brought into the board to represent administration and industry. Much more money was made available and new stations for the study of industrial problems in handling fish were shortly established on both east and west coasts. On careful consideration the first of these was established not at the center of government as in the United States nor at a foremost university research center as in Great Britain, but at Halifax, the most important center for the industry and with a university at hand. The second was established for political reasons at Prince Rupert, a remote fishing center, but has recently been transferred to Vancouver, which is comparable with Halifax.

The boom period of the twenties was gathering headway, with young men flocking into research as a profession and the public keyed up with great expectations. The chairmanship of the board went in 1925 to J. P. McMurrich, the anatomist, of Toronto, who as a young man trained under R. Ramsay Wright and enthused with the possibilities and need for biological research had publicly urged in 1884 such a development as was now in train. He had had a long experience in investigation at biological stations and universities in the United States, and he encouraged the directors of the four stations to develop the work. With departmental urging, the new experimental stations were quickly staffed with full-time investigators, and on the recommendation of a Royal Commission on Maritime Fisheries in 1928, this policy was extended to the biological stations. Annual expenditure, which had started at $2,000 in 1900 and had risen to over $46,000 by 1923, climbed rapidly to a peak of nearly $400,000 in 1930.

Then came the "depression," and in three years' time expenditures were cut by more than 50 per cent. With the board no longer dominated by men who wished to contribute personally to fisheries investigation and with increasing demands from the employed staff, financial support but not facilities available otherwise was withdrawn from volunteer workers from the universities.

The stations had grown in response to more or less local conditions rather than with central planning, but under the forceful chairmanship of the biochemist, A. T. Cameron, of Winnipeg, the organization was remodeled to achieve balance and smooth working, and so came to approximate the character of other research organizations. With centralization of direction and initiative, scientific output as judged by number and volume of publications dropped steadily in the face of increasing expenditure. In 1937, the Biological Board of Canada became the Fisheries Research Board of Canada, signalizing the change in forty years from a group of university investigators eager for facilities for personal investigation into a body of administrators, nine representing the most pertinent sciences in the universities, two the Department of Fisheries and four the fishing industry. This tripartite organization has permitted fusion of the varied points of view requisite for a successful policy of research toward fishery objectives.

In Ontario, the Great Lakes have offered a continuing challenge to biologists. R. Ramsay Wright on going from Glasgow to Toronto in 1874 responded to the challenge not only by training his budding investigators (including Macallum and McMurrich) on fresh-water material as in their combined work in monographing the catfish *Amiurus*, but by a lengthy report in 1892 upon the provincial fish and fisheries. He advocated a lake station which materialized on Georgian Bay under the board, but which languished and was abandoned in 1914. The board continued support of investigation of the Great Lakes until 1920, but, with Ontario then in control of its own fisheries, Bensley developed in 1924 the Ontario Fisheries Research Laboratory at the provincial University of Toronto, taking the smaller lakes for study as being more manageable and starting with Lake Nipigon.

First in 1920 did the board investigate lakes in the Prairie Provinces, namely, the interesting alkaline Quill lakes of Saskatchewan in which the stock of desirable fish comes and goes with long-period fluctuations in salinity. Steady investigation of the varied Prairie lakes began in 1925 with staff drawn from the University of Manitoba, and later augmented from the University of Saskatchewan; but, with these provinces assuming control of their natural resources, the work was discontinued after 1930.

An appeal for federal assistance to the Ontario Fisheries Research Laboratory led to the formation in 1936, under the auspices of the National Research Council and the Fisheries Research Board, of a National Committee on Fish Culture, which administers a grant to the council, by which aid has been given for work by university investigators on waters of the interior provinces. The aim of the committee is to survey and coordinate the whole field of fish culture research. Of somewhat similar character and similarly sponsored are the Canadian Committee on Storage and Transport of Food, formed in 1938, and the Canadian Committee on Oceanography, formed in 1939.

The vast northern or Arctic part of Canada has been given but sporadic attention in keeping with its virtually uninhabitable character. Stefansson may maintain it to be a friendly country, but neither he nor any one else has pioneered its successful settlement with people of European stock. The prevalent idea, doubtless a European product, that northern waters teem with life has maintained great hopes for development of fisheries, particularly among the people of the Prairie Provinces in regard to the inland sea of Hudson Bay, 500 miles in diameter. The board sent investigators to the bay and strait in the twenties, and one went with a modern steam trawler, sent by the department in 1930 to make a thorough search for fish other than those in the tributary streams and close to shore. Not a single commercial fish was obtained. This agreed with the experience of the Hudson's Bay Company in the eighteenth century, which with experienced Spitzbergen fishermen obtained only three fish for an expenditure of £20,000. That all the water of the bay except a shallow surface layer in the summer was found to have a temperature below $-1.8°$ C. explains not only its lack of commercial fish but also the high arctic character of its fauna. And yet it lies south of the latitude of Iceland, which has such notable fisheries.

To have more of the famous Malpeque oysters, particularly the "Curtain Island Cups," took the first station to that bay in Prince Edward Island in 1903 and 1904, with their life history to be elucidated. The mature English investigator (a member of the board), to whom had been assigned this phase of the work, lost caste by mistaking scale insects on planted brush for oyster spat and he complained later in *Nature* of the poor facilities for research. It was the "chore boy" of the station, Jos. Stafford, of Toronto and McGill Universities, who published ten years later a volume on "The Canadian Oyster, its Development, Environment and Culture." But the Malpeque oysters were almost exterminated in 1915 and 1916 by a disease, presumably introduced with seed oysters from Long Island Sound. When this was made a federal scientific and administrative problem, the board established in 1929 the Prince Edward Island Biological Station on the bay in charge of A. W. H. Needler. With scarcely any oysters left, it was possible to replace public fishing by private culture and with new methods the resistant stock that had developed in the inlets was extended to ever new areas. The industry grew so rapidly that in 1941 it was justifiable to issue a bulletin on "Oyster Farming in Eastern Canada."

Although producing more lobsters than any other country Canada had to have hatcheries, the first in 1891, but these failed to improve conditions. When shown by Knight to be worse than useless, they were abandoned in 1919. He tried out the rearing method of A. D. Mead, of Rhode Island, in 1914 and 1915 in the cold water of the Bay of Fundy with absolute failure and in 1916 in the warm water of Northumberland Strait with so little success that no further efforts have been made. Then the value of governmental hatching and planting of salmonids, which had been developed extensively in both the United States and Canada, but not in Great Britain, was brought into serious question by H. C. White's results in studying from 1923 to 1930 the fate of speckled trout fry planted in streams of Ontario and Prince Edward Island. A thorough test of the effectiveness of sockeye salmon culture was made by R. E. Foerster in a part of the Fraser River system, B. C., from 1925 to 1935, and it revealed results so incommensurate with cost that the artificial culture of sockeye salmon was abandoned by Canada in 1937.

These negative results leave open the question of what we should do to get more fish. Control of fish predators on sockeye salmon in British Columbia and of bird predators on Atlantic salmon in Nova Scotia has been not without promise, but the predation problem is a knotty one. Fish culture has been definitely successful for introductions into suitable barren waters. Starting from that solid fact, attempts are being made to develop effective regular use of the product of Atlantic salmon hatcheries for waters in which natural hatching is demonstrably unsuccessful or inadequate.

The United States, but not Canada, took membership for a time in the North European International Council for the Exploration of the Sea. In 1920, on the initiative of Canada, the North American Council on Fishery Investigations was formed in cooperation with the United States and Newfoundland. This has permitted Canadian fisheries research on the Atlantic to be closely stimulated by and coordinated with the investigations of the U. S. Bureau of Fisheries and the work of the Woods Hole Oceanographic Institution. Contacts were established with the European council, particularly through the fact that France, which belonged to that council, took membership in 1922 in the North American Council because of her fisheries on the Grand Banks.

The Passamaquoddy tidal power project at the boundary between the United States and Canada provided the council with a most difficult problem in fishery research. The St. Andrews Station, which had been studying the waters involved, believed that Canadian fear of serious injury to the local very concentrated "sardine" (small herring) fishery, largely Canadian, had some real basis, while the power project made a great appeal to the imagination of New England, particularly with the domestic market for the sardines having been ruined by liquor prohibition, since they had been used to stimulate thirst. The council could not state what effect the project would have and the investigation, which it recommended, lasting over two years and carried out by scientists from four countries, failed to provide the basis for sure forecast of the effect. A revised plan, considered as not apt to cause serious damage to the fisheries, was started by the U. S. Government, but abandoned after $6,000,000 had been spent "before ascertaining if the plans were technically sound" as stated in Science (Vol. 83, p. 508) by President Compton, of the Massachusetts Institute of Technology, who supported the statement that this project "breaks all records in getting the least electricity for the money."

International cooperation in fisheries research has gone farthest on the Pacific coast. As a background, there has been the treaty of 1911 between the two countries for the preservation and utilization of the fur seals of the Pribilof Islands, which has worked so satisfactorily. In 1924, the North Pacific Halibut Treaty between the United States and Canada became effective, and the commission that was appointed under its provisions has had continuous scientific investigation of the halibut problem. Outstanding has been its thorough attempt to test the theory of overfishing by following carefully the result of definite restriction in the catch. A more economic condition has resulted, namely, an increased yield per unit of effort, whatever may be the effect on the stock, which is not yet clear. There has, however, been some failure to control the catch. A similar commission for the sockeye salmon of the Fraser River came into being in 1937, taking over the scientific investigations carried on by the Fisheries Research Board of Canada. It is a question, however, whether the principal matter, the bringing back of the large runs eliminated by a rock slide at Hell's Gate in 1913 blocking the ascent of the fish, is not already being remedied by nature.

Difficulty in handling "fish" is due largely to its very perishable nature. For example, smut or blackening in canned lobster was found by Andrew MacPhail of McGill in 1898 to be iron sulfide associated with bacterial decomposition and he advocated more thorough sterilization of the cans. Then F. C. Harrison, of MacDonald College, reinvestigated it (1923) and recommended chemical control by use of acid pickle in the cans, but G. B. Reed, of Queen's, was able to show (1924) that the important thing was to avoid decomposition before canning, which might be serious in four hours' time.

Smoked fish (finnan haddies and smoked fillets) presented the first problem for the Halifax Station, but the trouble was found to be merely failure in muggy weather to dry the outer part quickly enough into a shiny pellicle before it was acted upon by the smoke which prevents the sheen from developing, and the housewife wanted the sheen. The good effects of the smoke proved to be due largely to the contained formaldehyde, which, curiously enough, the "pure food" laws prohibit from use for preservation of food. Frozen fish has had a poor reputation, and Canadian frozen hake was the subject of strong official complaint from the troops in France in the Great War. Rapid freezing and steady cold storage were found to give a prime product and, as a demonstration, many tons of really fresh haddock fillets were sold in Toronto in the frozen state in 1929 as a high quality product at a price 50 per cent. above that of the "fresh" fish. The trade has, however, as yet been unable to ensure proper handling at all stages from the water to the consumer. The Halifax Station has shown that the fishy odor of "fresh" fish, which is absent from fish that are really fresh, is the result of the setting free in sea fish of trimethylamine from trimethylamine oxide by incipient decomposition. Really fresh fish, which are without the fishy odor both during cooking and eating, which leave no aftertaste, and which could be greatly relished by many people, particularly invalids, who now dislike fish, is as yet practically unobtainable, through failure of the trade to use sufficient care and speed in handling. Tests showed that the "fresh" fish sold in winter when preservation is easier actually contained more trimethylamine than it did in summer.

In contrast with fish handling, the crying need in connection with the actual fishing is not for the application of the knowledge we have but for more knowledge. Fishery regulation like fish culture is still based for the most part upon hope, not upon assurance of effectiveness. Real advance requires freedom of thought, which will come only by removing the incubus of the past—time-honored beliefs without proved basis. "Homing of salmon" is a belief that satisfies and removes incentive to discover how that fish moves in the sea and why. "Races" of fish have an extensive literature without any facts of breeding and have so often been shown to be environmental effects that there are serious proposals to remove from "race" any implication of heredity. "Depletion," except as an uneconomic condition which may exist when fishing starts, is little more than a bogie to frighten the credulous. That it is so seems to me to be evident from E. S. Russell's recent (1942) book "The Overfishing Problem" (based upon his lectures at the Johns Hopkins University, which were sponsored by the late Raymond Pearl), since it is stated that "there is more than a risk—there is a threat—of destruction of stocks." Those who raise this bogie to get definite action conveniently ignore incompatible facts such as these: More herring (102,194,000 lbs.) were caught in the Canadian Passamaquoddy region (Bay of Fundy) in 1941 than ever before, although this region is fished more intensively than any other, with the chief incidence on the yearling fish less than half-way on the road to sexual maturity and with no protection for the spawners. Although Lake Erie is more intensively fished than any other of the Great Lakes, it yielded more whitefish in 1939 than is recorded for any earlier year and the Canadian catch (U. S. figures not available) was 45 per cent. higher in 1941 than in 1939. We have still much to learn.

INTERNATIONALISM IN SCIENCE[1]

By Dr. KARL K. DARROW
BELL TELEPHONE LABORATORIES

I HAVE been asked to speak on internationalism in science, or rather in the particular field of science which happens to be mine, the field of physics. The quickest way to handle this subject would be to reverse it, and speak of *nationalism* in science. This would be a conveniently narrow subject, for in science there is hardly any nationalism. The laws of nature are everywhere the same, and the ways of describing them do not differ from land to land. You may indeed remark that in different lands they are described in different languages. In so far as this is true it is not important, except as an inconvenience; and it is not even entirely true. The laws of nature are described by mathematics, and mathematics is a universal language. You can look at a book of physics in some language of which the very letters may be unfamiliar, and still you can tell what the author is treating by following the train of his equations. If you can read his words or get some one to translate them, you find that there is no imprint of nationality on his ideas, any more than on the laws which he happens to be describing.

So, the journals and the books of science are a cosmopolitan literature, and indeed the most cosmopolitan thing which now remains to us. In the happy days before the other war there were other cosmopolitan things: the gold standard, and the free circulation of art and of artists from country to country, and the worldwide diffusion of travel and trade with limitations so light that they now seem like freedom. These did not survive the other war, or survived it only in a crippled fashion; but the literature of science continued still to pass all boundaries even when its creators could not, a sort of intellectual gold standard by which the worth of every contribution and the standing of every contributor were appraised. Englishmen were not judged by Englishmen exclusively, nor Germans by Germans nor Americans by Americans; the common opinion of the scientific world was the court of first and last resort. No experiment was disregarded, no idea neglected because it came from the opposite side of a frontier. Few if any scientists strove to keep their ideas confined within their own countries. The notion of keeping a discovery undisclosed is repugnant, I can without exaggeration say it is revolting, to nearly every man of science. So few are the exceptions to this rule that we still look with wonder on Newton and on Cavendish, who were exceptions to it, and try to divine what peculiar quirk of personality made them such deviations from the norm. Nearly every one in science spoke to all who would listen, and nearly every one in the entire world of science was ready to listen to a new experiment or a new idea, from whatever part it came.

But even so, were there not some nations which were always the discoverers and the teachers, and others which were always the copyists and the learners? Nothing would seem more natural, and nothing could be further from the truth.

Take the four men whose consecutive labors enabled us to understand the motions of the heavenly bodies: Copernicus the Pole, Galileo the Italian, Kepler the German and Newton the Englishman. They were astronomers, but they were physicists also, for the laws of motion of the heavenly bodies are those of earthly bodies also, exemplified on a grander scale. Take the story of radioactivity. Radioactivity was discovered because x-rays had been discovered. The discoverer of x-rays was a German, but the man whom his work inspired was a Frenchman. Another Frenchman and his Polish wife carried on the study, and for a time it might have been thought that Paris was destined to be the center of all wisdom about radioactivity for ages to come. Not for a very long time, however! Not a decade had elapsed before every one who cared at all about this field was looking eagerly to England, and not because of an Englishman either, but because of a New Zealander whom a fellowship endowed in Britain had brought to Cambridge. The focal point of research in radioactivity traveled with this man to Montreal and then back again to England. It is Rutherford of whom I speak, the very man who later became the first of all men to achieve the transmutation of the elements. So long as he lived, the great Cavendish laboratory at Cambridge was the greatest scene of transmutation in the world. Now the art and science of transmutation are dispersed throughout all countries; they are cultivated in America most of all, largely because Americans invented the two very ingenious devices which are used to produce the very high voltages demanded for transmutation. It was, however, an Italian who first taught the world to use the most variously efficient of all the agents of transmutation, the agent which we call "the slow neutron."

---

[1] Broadcast, under the auspices of the American Philosophical Society, over Station WRUL on June 24.

I could tell the same sort of story for almost every achievement in physics, and the lesson would always be the same. Progress in science depends on the spirit of the brilliant man; and in this case above all, the spirit bloweth where it listeth, heedless of national boundaries and heedless of racial groups. There has never been a city which was the capital of physics as Vienna for a century was the capital of music. There has never been a nation which was preeminent in physics as France so many years was preeminent in painting. Metaphorically speaking, if you walk through the galleries of physics you do not find the masterpieces labelled "French School" or "Dutch School" or "Italian School." There is just one school of physics, and from its inception it has been the school of all civilized nations.

Those of my listeners who heard the prior programs of this series are probably expecting something more. You may be waiting now to hear me tell of some great scheme or schemes of formal international cooperation, set up and going on for the benefit of physics. But those who speak for other sciences, astronomy for instance, can give you more striking examples than I can. I might indeed mention the laboratories built and the equipment given by the Rockefeller Foundation for physicists in certain European lands—laboratories now, by tragic irony of fate, ruined by civil war or taken over by the Nazis. It is allowable to hope that soon they may again be serving their intended purpose, and that the example of great donations by private wealth across frontiers may survive to be followed by future generations.

More significant as yet has been the living aid interchanged by the nations—I mean, the students who have gone from their homelands to some other country, not to sit at the feet of a famous master (as the saying used to be) but to stand beside him and work with him upon some problem of his own selection. Few of the leaders of physics have worked entirely by themselves. Normally, the brilliant physicist requires aid, and the skilled intelligent aid of men who are almost his peers, to follow out the ramifications of his thought and to perform the experiments suggested by his ideas. Mostly his fellow-countrymen supply the aid, but not by any means always. Many a Canadian and many an Australian has brought his stone or stones to the edifice reared by a British physicist; many an American has done the like for a German in the days before the other war and in the days of the Weimar republic; many a Chinese and many a Japanese has done it for an American. The graduate schools of many a university were microcosms of a non-embattled world, little groups composed of many strangers working together in a comity and with a mutual understanding such as we all should like to see realized in the world at large. We ought to try to increase their number after this war, and do away with certain formal restrictions which impeded them from arising in certain parts of the world. Yet if there had never been any such group, or if there were never to be any such group again—even in that deplorable and highly unlikely case, science would still be international. It would be inevitably international, so long as the books and the journals were allowed to cross the frontiers. Every physicist sooner or later, and glad or sorry as he may be, finds collaborators springing up all over the world. They are taught by his experiments and by his calculations, and he is taught by theirs. It could not be otherwise. Ideas flow about the world like the lifeblood in an organism. If from any part of an organism the flow of blood is withheld, that part decays. The same is true of the organism of science and of thought. If any one doubts this, let him look upon the demonstration which for the past ten years has been presented by the enemy.

OBITUARY

FRANK SCHLESINGER

1871–1943

The death of Frank Schlesinger deprives American astronomy of its most distinguished authority upon precise astrometric measurement.

Born in New York, the son of Joseph and Mary Wagner Schlesinger, he received the degree of B.S. from the College of the City of New York at the age of nineteen. After five years' experience as a surveyor in his native city he studied for the doctorate at Columbia (Ph.D., 1898).

In the following year he began his astronomical career at the International Latitude Observatory at Ukiah, California, which he established, and operated for four years, as observer-in-charge. The visual observations demanded the highest attainable precision and care, and half of them had to be made in the morning hours. It was a severe introduction to astrometric work; but his enthusiasm for this somewhat austere type of investigation was life-long.

In 1903 he went to the Yerkes Observatory, where he spent two years in the photographic determination of stellar parallaxes, under the auspices of the Carnegie Institution. The precautions which were necessary to avoid systematic errors had been discussed theoretically by Kapteyn. Schlesinger's practical applications of these principles and his own ingenious inventions made his methods a standard which has been followed, with little change, in the thousands of determinations of trigonometric parallax made at many observatories ever since.

His most important personal contributions were the rotating sector, by which the image of a bright star is equalized with those of faint comparison stars, and the method of dependences, which greatly simplifies the reductions.

In 1905 he was appointed director of the Allegheny Observatory, and inaugurated an extensive program of observations for parallax with the 30-inch photographic refractor, and also researches on radial velocities and spectroscopic binaries.

The results of both were ably discussed. One example of his acumen may suffice. In all long series of observed stellar parallaxes, a few will come out negative—a geometrically impossible result, due to accumulation of observational errors. Most observers are irresistibly tempted to re-observe these stars, and the new series almost always give more reasonable values.

Schlesinger pointed out that this amounts to selecting for correction the cases in which the observational errors happen to combine in one direction, while ignoring those in which they had the opposite effect, so that the general mean of all the results would be systematically vitiated, and therefore resolutely avoided the practice.

He was called in 1920 to be director of the Yale University Observatory, where he remained for twenty-one years. Here he found an astrometric tradition which he continued, with increased equipment.

An observing station was established at Johannesburg, at which the parallaxes of hundreds of Southern stars were determined, and an extensive program of photographic observation of star-places inaugurated at New Haven. With the aid of specially designed lenses, the measurable area on a single plate was increased from about 5° × 5° to 12° × 15°—with great saving in the number of specially observed reference stars required for a given zone of the heavens.

The reduction of these large plates demanded the inclusion of terms negligible on small ones; but Schlesinger's ingenuity reduced the total work of computation to a remarkably small total per star. His introductions to the volumes of the Yale Zone Catalogues afford by far the best text-book for the student of the subject.

Almost his last work was a general catalogue of stellar parallaxes, in which the results of all observers, after careful study of their accidental and systematic errors, are combined—a task demanding exceptional judgment.

In all this work he showed the same characteristics—unremitting industry; thorough knowledge of the problems to be investigated, the instruments for observation and the physical and mathematical principles involved in the reductions; remarkable ingenuity in devising improvements in both; a deep love of accuracy, which never tolerated defects; and a well-proportioned sense of scientific economics, which resulted in a remarkable volume of excellent work from the available equipment.

His work brought him many honors. He was a member of the American Philosophical Society, the American Academy of Arts and Sciences and the National Academy of Sciences; a foreign associate of the Royal Astronomical Society and the Royal Society of Science of Upsala; a correspondent of the French Academy of Sciences and the Bureau des Longitudes. He was president of the American Astronomical Society (1919–1922) and of the International Astronomical Union (1932–1935). He received the degree of Sc.D. from Pittsburgh in 1920 and Cambridge in 1925, the Valz Medal of the French Academy, the Gold Medal of the Royal Astronomical Society, the Bruce Medal of the Astronomical Society of the Pacific and many other distinctions.

Those who knew him will think most of all of the qualities which do not appear in this formal account—his cordial hospitality, his unfailing kindness and good humor and his invariable high ideals. He was the moving spirit of the "Neighbors"—the group of astronomers who, without any formal organization, derived great profit, as well as pleasure, from their meetings at New Haven.

His advice—by which the writer profited often—was valuable not only because of his full grasp of the scientific bearing of a situation, but even more for his sympathetic comprehension of the human problems involved and the high-minded lucidity of his appraisal of its ethical implications. He will be sorely missed by many friends.

He retired from his position at Yale in 1941. Failing strength had led to a gradual curtailment of his activities, which he accepted with quiet and cheerful philosophy during two years of retirement. Then his health failed, and the end came on July 10.

He was twice married, in 1900 to Eva Hirsch, of Ukiah, who died in 1928, and in 1929 to Mrs. Philip

W. Wilcox, of New York. His widow and one son by his first marriage survive him.

Henry Norris Russell

Princeton University

ARTHUR WILLIS GOODSPEED

(1860–1943)

On June 6, 1943, Arthur Willis Goodspeed, a pioneer in the study of x-rays, died at Concord, N. H., a few miles from the small town of Hopkinton where he had been born eighty-three years before. A descendant of early New England settlers, the son of Obed and Helen (Morse) Goodspeed, he passed his early years in Boston. Graduating from the Boston Latin School, he entered Harvard College. Here he came under the influence of John Trowbridge and Benjamin Peirce, who encouraged him to pursue the study of the physical sciences in which he had shown marked aptitude even as a boy. In 1884 he graduated from Harvard, winning high honors in physics and mathematics.

Immediately after graduation he was offered a position as assistant in physics at the University of Pennsylvania. As this provided an opportunity for advanced study, he accepted it, and this decision determined the scene of his life-work. He enrolled in the newly established graduate school of that university, and in 1889 received the degree of Ph.D., being, incidentally, the first recipient of a degree from that school.

At this time the chair of physics was held by George F. Barker, a scientist of international reputation. Goodspeed's association with this brilliant lecturer gave him invaluable experience and inspiration. He continued under Barker through the grades of instructor and assistant professor, succeeding him when he retired in 1900, and continuing as director of the laboratory until he himself reached the age limit in 1931. Thus, his teaching service of nearly half a century was wholly spent at this one institution.

The period of his service was one of rapid growth of the university and of the department of physics. He saw in his time its staff and its activities increase ten-fold. Much of the success of the many adjustments made necessary by this expansion was due to the administrative skill, ready decision and quiet tact which he exhibited.

As a lecturer he carried on the tradition of his predecessor in sparing no pains to devise ingenious and striking experiments with which to emphasize the essential aspects of his subject. Even after the pressure of administrative duties compelled him to give up much of his formal teaching he would frequently, in presenting new developments in physics, devote great care to illustrate them with clever and interesting demonstrations.

He was early attracted by the scientific aspects of photography—an interest which he retained throughout his life and which perhaps dated from the time when, as a young instructor, he witnessed and assisted at the famous experiments of Muybridge on animal locomotion. What wonder, then, that the report of Röntgen's discovery in 1896 strongly drew his attention and that he became one of the earliest investigators of the new rays? He at once recognized their importance from the medical point of view and, in collaboration with many physicians of the city, carried on numerous investigations on osseous malformations, the location of foreign bodies and similar topics. In this work he developed an experimental technique that was at that time unexcelled. Indeed, some of his plates taken then compare favorably with those of the present day.

His studies of the physical and therapeutic properties of the rays also were begun at this period and carried on for some years. He later investigated the properties of the secondary x-radiation. His work in the field of radiology was recognized by his election in 1902 as president of the American Röntgen Ray Society.

The increase of his official duties put a check to these investigations, though they were never wholly discontinued. The administration of the laboratory and service as chairman of important faculty committees demanded much of his attention. For some years he served on the board of managers of the Franklin Institute. In 1901 he was elected secretary of the American Philosophical Society. His faithful and efficient service in performing the duties of that responsible office will be remembered by many of its members. When he resigned the position in 1935 he was appointed editor of the society's publications and continued as such until a year before his death.

Goodspeed was married in 1896 to Annie H. Bailey, of Hyde Park, Mass. Their children were Frederick, who lost his life in a parachute accident in 1928, Willis and Helen (Mrs. John R. Skeen). In 1913 he married Ethel W. Mitchell, of Staunton, Va. Their son, Arthur, is at present Lieutenant in the armed services of the United States.

Though his professional life was passed in Philadelphia, Goodspeed always retained an affectionate attachment to his New England home. He usually spent his summers at Hopkinton and took part in many of its civic activities. And when his work was finished he returned to his native town to enjoy quietly the close of his life, which was to be so soon terminated.

Goodspeed always retained his sturdy New England characteristics. His thrift and skill in management served him well in the administration for many years of a department which never received adequate financial support. His relations with his associates were most cordial, and he was always solicitous for their interests. The writer will ever hold in memory with pleasure and gratitude the encouragement, advice and cooperation which he received during the many years of their association.

HORACE C. RICHARDS

RECENT DEATHS

DR. ROBERT B. HINMAN, professor of animal husbandry at Cornell University, died in his fifty-fifth year on July 26.

EDWARD HALL BOWIE, regional director for the Pacific States of the United States Weather Bureau at San Francisco, president of the American Meteorological Society, died on June 29 at the age of sixty-nine years.

ALBERT KINGSBURY, founder and president of the Kingsbury Machine Works, Philadelphia, died on July 28 at the age of eighty years.

DR. ORVILLE HARRY BROWN, specialist in internal medicine, died on July 26 at the age of sixty-eight years. Recently he had been collaborating with Dr. John Lawrence, of the University of California at Berkeley, in experiments using cyclotrons to combat malignant growths.

THE death on July 28 at the age of sixty-one years is announced of Sir Harold Beckwith Whitehouse, gynecologist, president of the British Medical Association.

SCIENTIFIC EVENTS

THE DEATH-RATE IN GERMANY[1]

RECENTLY published statistics of mortality rates in German towns show that the health of the urban dweller has been steadily deteriorating, and this is especially marked during the later months of 1942. The following figures refer only to the large towns of "Greater Germany" with a total population of 24,500,000.

Compared with the corresponding months of 1941, infant mortality rose by 17 per cent. during the last quarter of 1942 to 69 per 1,000 live births. For the whole year the rate was 66, against 59 for 1941. This contrasts with a record low rate for England and Wales during 1942 of 49. Among children aged one to five—another sensitive index of health—the number of deaths rose sharply in 1942 to 7,236. In previous years the number had been 6,404 in 1941, 6,062 in 1940 and 5,670 in 1939.

School children aged five to 14 are also being affected, but adolescents seem to be affected more than any other group. For ages 15 to 20 a rise of 38 per cent. in 1942 was recorded over the number of deaths in 1939. The numbers were: 4,159 in 1942, 3,192 in 1941, 3,126 in 1940, and 3,023 in 1939. Contributing to these significant upward trends in mortality among children were sharp increases in the number of deaths from diphtheria and scarlet fever.

The report also shows a steeper rise in deaths from tuberculosis. There were, in German towns, nearly 5,500 more deaths from all forms of tuberculosis in 1942 than in 1939. The death-rate per 1,000 population at all ages was 24 per cent. higher in 1942 than in 1939, and the rise was more rapid in 1942 than in 1941.

The new statistics disclose a sharp rise in the number of suicides. In the last four years the numbers have been 7,647 in 1942, 6,222 in 1941, 6,104 in 1940 and 6,387 in 1939. It has been the experience of most belligerent countries in this and in past wars that the suicide rate declines during hostilities. This has happened in Britain during the present war, and in Germany the number fell in 1940. The last quarter of 1942 showed, however, a rise of 87 per cent. (to 2,538) over the number registered during the corresponding quarter of 1940 (1,358).

It does not appear that political murders or suicides in concentration camps are included in the official statistics; nor does it seem that suicides of imported workers are included.

All these death-rates for the large towns are likely to underestimate the actual rise in mortality. There are several reasons to support this view.

The evacuation of children, mothers and expectant women to rural areas might be expected to reduce the number of deaths in the towns.

As the official statistics relate only to civilian deaths, the transference of large numbers of adolescents into the armed forces would reduce the civilian population exposed to the risk of tuberculosis.

The removal of hospitals, institutions and sanatoria from the Ruhr and Rhineland towns to rural areas should reduce the number of urban deaths—unless the register of deaths is retained in the town records.

Turning from deaths to births, the latest figures show a dramatic fall in the birth-rate. For the large towns of Germany the number of births in 1942 declined by 80,000 from the figure of 419,000 for 1940. The rate per 1,000 total population was down to 13.9 in 1942 compared with 17.3 in 1940.

The last quarter of 1942 recorded a rate as low as 12.7. This experience for German towns is borne out by the rate for all areas of Greater Germany, which had declined from 20.4 in 1939–40 to 15.2 in 1942—a loss of approximately 550,000 live births.

---

[1] From *The Times*, London.

UNITED STATES LECTURERS IN BRAZIL

Advanced practices in the application of the science of metallurgy in the United States will be made available to Brazilian scientists and industrialists during the coming year through a technical educational project established at the Escola Politecnica of the University of São Paulo, one of the leading engineering schools of Brazil. Four distinguished United States scientific men have been appointed to give lectures on fundamental metallurgy over a period of a year, each to remain in residence there for three months during the extent of his lecture series. The project is being jointly financed through the office of Nelson A. Rockefeller, coordinator of Inter-American Affairs, and the Escola Politecnica. It is administered by the Stevens Institute of Technology under a contract with the coordinator's office.

The first lecturer, Dr. A. Allan Bates, manager of the chemical and metallurgical department of the Research Laboratories of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., is already *en route* to Brazil and was expected to be at the University of São Paulo by July 29.

He will be followed by Dr. Robert F. Mehl, professor and head of the department of metallurgical engineering and director of the Metals Research Laboratory of the Carnegie Institute of Technology, Pittsburgh; Professor Arthur Phillips, of the Hammond Metallurgical Laboratory, Yale University, and Professor Gregory Jamieson Comstock, director of the powder metallurgy laboratory of the Stevens Institute of Technology.

Laboratory facilities for metallurgical work are available at the Instituto de Pesquisas Tecnologicas, which is connected with the Escola Politecnica. Modern research and production equipment is provided by electric arc melting furnaces, induction furnace, small rolling mill, cupola furnace and complete microscopic and metallographic apparatus. It is the desire of the Escola Politecnica to inaugurate a complete series of courses in fundamental and advanced metallurgy.

The project was initiated when the Brazilian institution asked the help of the coordinator of Inter-American Affairs in obtaining the teaching services of four professors of metallurgy. The coordinator's office solicited the advice and counsel of the engineering division of the Board of Economic Warfare, now the Office of Economic Warfare.

The problem was assigned to Professor Comstock, of the Stevens Institute of Technology, who is a technical consultant for the division and who suggested the plan which was adopted. The institute accepted the responsibility for administering and supervising the program. The lecturers were appointed by the trustees with the consent and cooperation of their own institutions or industrial employers.

The subject to be taught, fundamental metallurgy on a graduate level, will be presented in four divisions by the lecturers, each of whom is regarded as preeminent in his particular field. Dr. Bates will lecture from the viewpoint of industrial research and development; Dr. Mehl on the physical metallurgy of iron and steel; Professor Phillips on non-ferrous metallurgy, and Professor Comstock on powder metallurgy. They also will assist the university authorities to develop a curriculum in metallurgical engineering.

THE PROPOSED OCEANARIUM AT CONEY ISLAND

Tentative plans for the proposed post-war Aquarium or Oceanarium to be built at Coney Island at an estimated cost of $1,500,000 are described in *The New York Times.* It will take the place of the old Aquarium at Battery Park, and will extend nearly ten acres between the Boardwalk and Surf Avenue, from West Fifth to West Eighth Streets. The site is virtually already owned by the city.

The Times states that in addition to a modern main marine building housing fresh and salt-water species from every part of the globe and outdoor pools for seals, penguins and cormorants, it is planned to construct a children's aquarium. As shown in a tentative sketch, this will be a building resembling an old schooner, anchored in a pond off the main building.

Observation cat-walks will be constructed around the huge tanks and through them. In the latter the observer would find himself literally "inside" the tank, encased in a glass passageway with water under, around and above him.

There will be, according to present plans, exhibits of tropical, temperate, Arctic and biological specimens, a separate section for aquatic birds and waterfowl, a promenade deck, lecture hall and restaurants. An over-pass will lead directly to a special subway entrance and a parking lot will be constructed to accommodate 450 automobiles.

The Finance Committee of the City Council has unanimously approved an amendment to the capital budget for 1943 to include the sum of $42,000 for preliminary plans and study of the oceanarium. It is expected that the New York Zoological Society will contribute an additional $20,000 toward the cost of preliminary planning.

STUDY OF GERMICIDES AND BACTERICIDES AT THE OHIO STATE UNIVERSITY

AN intensive investigation of germicides and bactericides, including anti-malarials, has been undertaken by the Research Foundation of the Ohio State University, of which Dr. A. R. Olpin is director. This has been made possible through a grant of $23,000 by the William S. Merrell Company, pharmaceutical manufacturers of Cincinnati.

The grant takes the form of the establishment of three annual post-doctorate and three annual graduate fellowships in bacteriology and chemistry. Members of the regular university staff who will also contribute to these studies are Dr. J. M. Birkeland, Dr. G. L. Stahly and Professor A. R. Winter, all of the department of bacteriology, and Dr. W. R. Brode and Dr. W. G. France, of the department of chemistry.

Investigations of anti-malarials to be conducted at the university will be correlated with the work going on in many other laboratories throughout the nation. An investigation of penicillin, the new and very potent germicide or bactericide derived from mold, is planned. This work is part of a larger program of research coordinated by the Committee on Medical Research in Washington. The new projects are the outgrowth of a number of years of friendly cooperative relations between the foundation and the Merrell Company.

Many valuable and practical discoveries have been made through these researches, including a promising new method of synthesizing menthol. This is especially important at the present time as the supply of menthol from the Far East has been virtually cut off by the war.

WORK OF THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS

BASIL O'CONNOR, president of the National Foundation for Infantile Paralysis, announces that three records in the 1943 infantile paralysis fund-raising appeal—in the amount raised, in the number of contributors and in conducting the appeal at a lower expense than any previous campaign—exceed all previous results by more than 30 per cent.

Net collections amounted to $5,527,590. This is $1,500,000 higher than any previous year. Expenses were $147,871, or only 2.6 per cent. of collections. Mr. O'Connor estimated that there were more than 35,000,000 contributors.

The Motion Picture Theaters Drive, headed by Nicholas M. Schenck, president of Loew's, Inc., and Harry Brandt, president of the Brandt Theaters, raised $2,086,596. The National March of Dimes to the White House amounted to $570,000.

Half the funds collected go to the National Foundation for the broad front attack on the disease, including research work, education and epidemic aid, while the other 50 per cent. remains with local chapters of the foundation covering practically all the nation's 3,070 counties where it is used for local relief for victims of infantile paralysis, regardless of age, race, creed or color.

Mr. O'Connor stated that this country may face a severe test this year in coping with infantile paralysis due to a marked increase in the number of cases during the first six months. He said that "as of to-day, more cases have occurred in 1943 than for a comparable period during the past nine years, the number being double that of last year at this time. So far the epidemic has appeared in California, Texas and Oklahoma. First, southern California was involved. Then the epidemic spread to the San Francisco Bay area. Now there is some increase in Washington. In a similar way the epidemic has spread northward, with the advancing season, from Texas into Oklahoma. At this time Kansas shows an increase." Dr. John L. Lavan, assistant medical director of the National Foundation, with equipment and a staff of workers, has been sent to the areas affected.

THE LIBRARY OF SIR ISAAC NEWTON

ACCORDING to *The Times*, London, the Pilgrim Trust has bought from Messrs. Henry Sotheran, Limited, a collection of 858 books which once belonged to Sir Isaac Newton. The trustees also bought from the same firm Newton's copy of the Old Testament in Greek and his copy of Isaac Barrow's edition of Euclid's Elements. They have decided to offer all the books they have acquired to Trinity College, Cambridge, and the master has expressed the readiness of the college most gratefully to accept the gift.

Charles II made Barrow Master of Trinity and during his short tenure of the post he founded the magnificent college library. Before this dignity had been conferred on him, Barrow, the divine, had declared that he could not make a bible out of his Euclid, or a pulpit out of his mathematical chair, and in 1669 he resigned the Lucasian professorship of mathematics in favor of his still more distinguished pupil, Isaac Newton. Eighty-three of the books show actual marks of Newton's handwriting, of which twenty have his autograph signature. Four of these are of special interest, as they bear the date of 1661, the year in which Newton entered Trinity College. Newton represented the university as a Whig in the Convention Parliament of 1691.

SCIENTIFIC NOTES AND NEWS

As noted in Science last week, Dr. George D. Birkhoff, Perkins professor of mathematics at Harvard University, has been elected an honorary fellow of the Royal Society of Edinburgh. Other Americans elected to honorary fellowships were Dr. H. S. Gasser, director of the Rockefeller Institute for Medical Research; Dr. Herbert S. Jennings, Walters professor of zoology, emeritus, of the Johns Hopkins University, and Dr. Oswald Veblen, professor of mathematics at the Institute for Advanced Study at Princeton, N. J.

Sir Henry Hallett Dale, president of the Royal Society, London, a member of the Scientific Advisory Committee of the British Cabinet, was presented on July 8 with the Harben Gold Medal of the Royal Institute of Public Health. The Smith Award was presented to Dr. James Fenton, medical officer of health for Kensington. Former recipients of the Harben Medal include Pasteur, Lister, Koch, Metchnikoff, Gorgas, Baron Kitazato, Sir Ronald Ross and Sir Leonard Hill.

Dr. John J. Grebe, director of the Physical Research Laboratory of the Dow Chemical Company, Midland, Mich., will be presented with the Medal of the Society of Chemical Industry for 1943 at a meeting in November of the American Section in New York.

Kansas State College recently conferred the honorary doctorate of science on Dr. P. J. Parrott, formerly director of the New York Agricultural Experiment Station at Geneva.

Nature states that the University of Aberdeen has conferred the honorary degree of LL.D. on Dr. D. M. S. Watson, Jodrell professor of zoology and comparative anatomy, University College, London. The degree of D.Sc. has been awarded to W. Burns for a thesis on "An Oscillographic Study of the Activity in Nerves Associated with the Viscera"; and on Dr. R. D. Stuart, for a thesis on "A Study of Leptospirosis in the South-West of Scotland with Special Reference to Laboratory Investigation, Epidemiology and Specific Prophylaxis."

The Council of the Royal College of Surgeons of England has conferred honorary fellowship on the Right Honorable Winston Churchill, Prime Minister, First Lord of the Treasury and Minister of Defense.

Dr. Edward Frankland Armstrong has been elected president of the Royal Society of Arts, London.

The retirement on July 1 is announced of Dr. E. M. Freeman, dean of the College of Agriculture, Forestry and Home Economics of the University of Minnesota. He is succeeded by Dr. Henry P. Schmitz, professor and chief of the Division of Forestry.

Dr. Charles C. Adams, since 1926 director of the New York State Museum, retired on July 31, having reached the statutory age of seventy years.

The title of professor emeritus of the history of medicine in the University of London has been conferred on Dr. Charles Singer on his retirement from the professorship of the history of medicine at University College.

Professor William I. Myers, head of the department of agricultural economics, a former governor of the Farm Credit Administration, has been appointed acting dean of the New York State College of Agriculture at Cornell University, filling the vacancy caused by the death of Dr. Carl E. Ladd.

Professor George D. Scarseth, of Purdue University, has been appointed head of the department of agronomy. He succeeds Professor A. T. Wiancko, who had served since 1903 as professor of agronomy and head of the department.

Dr. Russell A. Runnells, associate professor of pathology in the Division of Veterinary Medicine of Iowa State College, has resigned to become head of the department of anatomy in the Division of Veterinary Science of the Michigan State College, East Lansing.

Dr. Ralph G. Smith, of the Medical School of the University of Michigan, has been appointed to succeed Dr. Erwin E. Nelson as professor of pharmacology and head of the department of pharmacology of Tulane University.

Dr. Anthony A. Pearson, assistant professor of anatomy at the Loyola University School of Medicine, Chicago, has become associate professor of anatomy at the College of Medicine of Baylor University at Houston, Texas.

Dr. Leslie L. Lumsden, of New Orleans, medical director of the U. S. Public Health Service, retired, has become lecturer in epidemiology at the Medical Branch at Galveston of the University of Texas.

Chemical and Engineering News states that Roy Erwin Swift, formerly instructor of metallurgy in the School of Mines, University of Alaska, has been appointed associate professor of chemistry at the university. The School of Mines has been discontinued for the duration of the war, but the first two years of the basic engineering sciences are to be continued.

Dr. Edward B. Mathews has retired as head of the Maryland Geological Survey. Dr. Joseph T. Singewald, Jr., has been appointed his successor as director of the Department of Geology, Mines and Water Resources.

Dr. William E. Martin has resigned as associate horticulturist in the Arizona Agricultural Experiment Station to become senior agriculturist with the Office of Foreign Agricultural Relations in Peru of the U. S. Department of Agriculture.

Dr. L. Grant Hector, chief engineer with the National Union Radio Engineering Company of Newark, N. J., has been appointed production consultant of the War Production Board. He will advise on miniature tubes in the radio division to increase production and improve quality through the coordinated efforts of the manufacturers.

George W. Burpee, a director of the American Society of Civil Engineers, a past president of the American Institute of Consulting Engineers, a partner in the engineering firm of Coverdale and Colpitts, has been elected president of the General Aniline and Film Corporation to succeed Robert E. McConnell, who has resigned.

Dr. Ernest W. Landen, research physicist with the Armour Research Foundation, Chicago, has become research engineer with the Caterpillar Tractor Company, Peoria, Ill. He will continue studies on Diesel combustion.

Dr. Mary Louise Quaife, assistant in the department of physiology of the University of Illinois, has become research biochemist at Distillation Products, Inc., Rochester, N. Y.

During the summer Professors Edward D. Allen and Albert G. Hart, of the department of economics of Iowa State College, are engaged in tax research for the Treasury Department at Washington.

The annual meeting of the Corporation of the Marine Biological Laboratory will be held in the auditorium of the laboratory at Woods Hole, Mass., on Tuesday, August 10, at 11:30 A.M., for the election of officers and trustees and the transaction of such business as may come before the meeting.

The Alabama legislature at its recent session made an annual appropriation of $100,000 to the State University for research purposes. This was in addition to the usual maintenance and building grants.

The Alabama Research Institute, recently organized by a group of Alabama business men, is setting up research fellowships in the state university and state colleges.

The Winthrop Chemical Company has announced plans for a large increase in the production of penicillin. Additional facilities for its manufacture have been acquired in Rensselaer, N. Y., and according to Dr. Theodore C. Klumpp, president of the company, will be devoted entirely to the manufacture of the drug which is now allocated exclusively to the armed forces. Penicillin is now under direct allocation of the War Production Board for national defense and there is no prospect that a surplus will soon be available for civilian use.

The *Journal* of the American Dental Association announces that the United States Department of State, in a letter from Secretary Cordell Hull to Daniel F. Lynch, chairman, has commended the work of the Pan-American Relations Committee of the American Dental Association, stating that "it is contributing in no small measure to that international understanding which is fundamental to world peace." The Pan-American Committee, in conjunction with the Department of State and the W. K. Kellogg Foundation, is sponsoring the Inter-American Postgraduate Course in Dentistry, which opened at the University of Michigan on August 2.

The *Journal* also announces that certain changes have been made in the dental program at Harvard University now being carried forward by the new School of Dental Medicine, including reduction of the course from five years, as set in 1940, to four academic years or three calendar years under the accelerated wartime schedule; award of the D.M.D. degree only on the completion of the course, and the permission of students successfully completing the course for the D.M.D. to register subsequently in the medical school and qualify for the M.D. degree on the completion of one and a half additional academic years or one additional calendar year in the medical school. When the activities of the Harvard School of Dental Medicine were planned with funds of $1,350,000 in July, 1940, a five-year course was established, at the end of which the successful student was given both the M.D. and the D.M.D. degree. According to an official statement by President James B. Conant, it was predicted from the start that difficulty would be encountered under the plan because a man enrolled for the joint degrees might shift his interest to some other branch of medicine rather than to continue with the course for the D.M.D. degree. Dr. Conant said: "The prediction of difficulty was accurate. Whether or not this would have been the case except for the war, no one can tell. Instead of the course of five academic years we planned, Army and Navy regulations now make mandatory the limitation to three calendar years in courses leading to the medical and the dental degree."

The Times, London, reports on July 10 that the Combined Food Board has made arrangements for an investigation to be made into available statistical records and other data concerning food supplies and consumption in the United States of America, the United Kingdom and Canada. Three United States officials have arrived in England to confer with officials of the Ministry of Food. They are Dr. John M. Cassels, Dr. Montell Ogden and Dr. L. A. Maynard, all of the U. S. Department of Agriculture. The Canadian Government is also participating in this inquiry. Ian Mcarthur, of the Canadian Dominion Bureau of Statistics, has also arrived in England. Personal discussions will supplement the full exchange of information on food matters which is already taking place through the established channels of the Combined Food Board.

Chemical and Engineering News reports that the embargo placed on the export of scientific periodicals by the United States is proving a heavy blow to Swedish investigators. Several prominent research workers in the April 7 *Stockholm's-Tidningen* express serious concern over their inability to keep abreast of scientific progress and new discoveries made in the United States. Professor Arne Tiselius, of the University of Uppsala, is quoted as saying, "It is vital for Swedish science to maintain contact with American research." Since the United States entered the war no scientific literature, with but few exceptions, has entered Sweden. A list of a hundred indispensable periodicals is being compiled and will be submitted to the authorities with an appeal that steps be taken for them to be regularly sent to Sweden. The *News* further reports that Swedish-British scientific cooperation has been made possible through an offer by the British Council to underwrite the printing in English of such Swedish doctors' theses as are of interest to the English-speaking scientific world. This offer, much appreciated in Swedish scientific circles, has been submitted to all universities and colleges in Sweden.

The British Medical Research Council has arranged with the London Hospital for the establishment there of a department for research in industrial medicine. Dr. Donald Hunter, physician to the hospital, has accepted a part-time appointment to the staff of the council as physician-in-charge of the department, and the council has appointed Dr. Kenneth Perry and Dr. Norman Spoor as full-time research assistants to work under his direction. The hospital is providing accommodation and facilities, and will be responsible for the treatment of cases under investigation. The primary purpose of the department is to undertake clinical researches into disorders affecting industrial workers, including both occupational diseases and others of a more general kind. This work will be done mainly in the department itself, but the staff will make visits from time to time to other parts of the country where special problems for investigation may be brought to the notice of the council. The department will also be responsible for teaching and instruction in the subject. This arrangement supersedes that made last year for the appointment of a whole-time director of research in industrial medicine attached to the council's headquarters. The post had become vacant through the appointment of Professor A. W. M. Ellis to the regius chair of medicine at the University of Oxford.

It is reported that an institute for typhus research has been opened at Lemburg. It has been named after Emil von Behring.

DISCUSSION

THE DIGESTION OF LIVING TISSUES BY PROTEOLYTIC ENZYMES[1]

The insusceptibility of living bacteria, yeast cells, etc., to digestion by proteolytic enzymes has intrigued many investigators and a number of explanations for this resistance have been suggested.[2] Whatever the nature of this insusceptibility it is of a type which is easily lost. On death or injury a change occurs (protein denaturation?), which permits digestion to take place. In striking contrast to the resistance of these living forms is the susceptibility to digestion which mammalian tissues exhibit.[3] The present observations appear to suggest an explanation for the ability of proteolytic enzymes to digest living mammalian tissues in spite of the strong probability that these tissues possess the same protoplasmic and cellular characteristics upon which the insusceptibility to digestion of the freely living forms depends.

Trypsin has been shown to be capable of liberating histamine from mammalian tissues. This has been demonstrated for the perfused lungs of guinea pigs,[4] for the blood cells of rabbits[5] and for the liver of dogs.[6] Some recent observations with the trypan blue test in rabbits indicate that the ability of trypsin, when injected intracutaneously, to cause a localization of the intravenously injected dye at the injection site, probably depends upon a local liberation of histamine from the skin and the consequent increased capillary permeability which this agent causes.[7] While observing these trypan blue reactions it was noted that adequate concentrations of trypsin digested the skin at the injection site, but that a marked dye localization always preceded the digestion. Also, it was found that weak concentrations of enzyme could produce definite localization of dye without subsequent digestion. These observations suggest that the local liberation of histamine is primary to, and possibly essential for, the ensuing digestion. To test this hypothesis, it was found that the concomitant injection of histamine with trypsin increased the amount of local digestion produced by the latter and would enable otherwise ineffective concentrations of enzyme to produce digestion. The histamine concentrations used did not cause any necrosis when injected alone.

---

[1] This research has been aided by a grant from the Clara A. Abbott Fund of Northwestern University.

[2] J. H. Northrop, "Crystalline Enzymes." New York: Columbia University Press. 1939.

[3] L. R. Dragstedt, *Arch. Surg.*, 44: 438, 1942.

[4] M. Rocha e Silva, *Arquivos d. Inst. Biol.*, 10: 93, 1939.

[5] C. A. Dragstedt and M. Rocha e Silva, *Proc. Soc. Exp. Biol. and Med.*, 47: 420, 1941.

[6] M. D. Ramirez de Arellano, A. H. Lawton and C. A. Dragstedt, *Proc. Soc. Exp. Biol. and Med.*, 43: 360, 1940.

The vitality of organized tissue is closely dependent upon the integrity of its vascular supply. Histamine is a potent angiotoxic agent, producing both marked contraction of arterioles and marked dilatation with increased permeability of capillaries. Thus trypsin releases an agent capable of embarrassing the vitality of tissues which depend upon a vascular supply. Its ability to digest organized tissue would appear to be conditioned by its ability to produce initially a sufficient degree of tissue injury to cause the cells to lose their specific insusceptibility to digestion. Free living cells (bacteria, etc.) are not injured by histamine (even if it is released from them) because its cytotoxic action is weak and there is no vascular system through which injury can be produced indirectly. Thus, while these observations do not explain the nature of the insusceptibility of living cells to tryptic digestion, they suggest an explanation for the ability of trypsin to digest organized tissue which obviates the alternative necessity of assuming that there is a fundamental difference in the protoplasm of the two types of tissues.

CARL A. DRAGSTEDT

DEPARTMENT OF PHARMACOLOGY,
NORTHWESTERN UNIVERSITY
MEDICAL SCHOOL

VITAMIN C IN EVERGREEN-TREE NEEDLES

IN his special report to SCIENCE[1] on the work of Soviet botanists, B. Shishkin says, in part, "Quite recently it was discovered that needles of ordinary pine trees contain large quantities of vitamin C. Biochemists in Moscow and Leningrad have organized mass production of vitamin C concentrate from pine needles. Despite the fact that the percentage of vitamin contained in needles is very small, this source of vitamin C is of particular value to us on account of the huge pine forests throughout the whole territory of the Soviet Union. . . ."

This report reminded me of the following account by Parkman in his book, "Pioneers of France in the New World":[2] "A malignant scurvy broke out among them. Man after man went down before the hideous disease, till twenty-five were dead, and only three or four were left in health. . . . Cartier, walking one day near the river, met an Indian, who not long before had been prostrate like many of his fellows with the scurvy, but who now, to all appearance, was in high health and spirits. What agency had wrought this marvellous recovery? According to the Indian, it was a certain evergreen, called by him *ameda*, of which a decoction of the leaves was sovereign against the disease. The experiment was tried. The sick men drank copiously of the healing draught,—so copiously indeed that in six days they drank a tree as large as a French oak. Thus vigorously assailed, the distemper relaxed its hold, and health and hope began to revisit the hapless company." Parkman gives the opinion in a footnote that "The wonderful tree seems to have been a spruce."

MAURICE DONNELLY

RIVERSIDE, CALIF.

TRANSLITERATION OF RUSSIAN NAMES

THE recent communications of Knight[1] and Hrdlička[2] contained pertinent comments on the problem of representing Russian names and titles in American journals. It was a surprise to me, however, that neither referred to the Library of Congress catalogue rules for transliteration. As American scientists are becoming increasingly familiar with Slavic literature it would seem worth while calling attention to this method of transliteration with one or two comments on its use.

It has been my experience in studying translations, maps, gazeteers and catalogues of Russian work that a number of different systems are used which vary more or less from one another. The principal cause of transliteration confusion (particularly on maps and in library catalogues) is the fact that every one uses a different method. The worst system now in use would be the best one if it was employed by every one; *e.g.*, the Russian я (pronounced *ja*, like the German "yes") is currently transliterated by any of the following letters and combinations according to the phonetic interpretation of the transliterator: ia, ya, j, ja or a. Possibilities for confusion are obvious. One need only reflect that a name beginning with this letter may be placed in four different positions in a Roman alphabet index. Although Russian orthography is highly phonetic (in contrast to the English), there are some cases of variability in the pronunciation of letters. This also results in various transliterations and consequent confusion in the index.

---

[7] M. Rocha e Silva and C. A. Dragstedt, *Jour. Pharm. and Exp. Therap.*, 73: 405, 1941.

[1] SCIENCE, April 16, 1943, pp. 354–355.

[2] Francis Parkman, "Pioneers of France in the New World," 17th ed., pp. 194–195. Boston: Little, Brown and Company, 1880.

[1] SCIENCE, April 30, 1943.

[2] SCIENCE, March 12, 1943.

The Library of Congress employs a system which I do not like as a student of language but have adopted for practical purposes in my scientific studies. This system provides us with an equivalent for every Russian letter. As there are more letters in the Russian alphabet than in the current American alphabet, some diacritical signs and vowel and consonant combinations are used in conjunction with our own 26 letters. Although *approximate* phonetic rendering is obtained, the rules provide for use of the same equivalent *invariably* regardless of pronunciation. This is an essential regulation for maintaining so-to-speak "index integrity." Although one does sacrifice some phonetic value in strict adherence to the Library of Congress rules, it is the most nearly standard system, and in the interests of uniformity I urge its adoption by scientists dealing with Slavic literature. A diagrammatic résumé is on file in libraries and may also be obtained from Washington, D. C.

D. G. Nichols

Garden City, New York

In Science for March 12 (p. 243) Dr. Hrdlička commented on the unfortunate lack of uniformity in transliterations of Russian names. He was justified in his criticism, which is supported by Dunlap in Science for April 30. The same name ending in "v" I have sometimes found transliterated in various publications four different ways, *i.e.*, "v", "w", "f" and "ff". Uniformity could be secured easily if the rules of the American Library Association were followed by at least all American writers. I have found a 3 × 5 inch library card published by the Library of Congress and carrying this system, most convenient in checking my memory of the transliterations.

The ligatured diphthongs used in this system involve a difficulty in publication, as these characters are not included in the equipment of any presses known to me, which use monotype machines. By omitting the arc which is used as a ligature, this trouble can be avoided. I have done this with a note stating the policy, and I know of at least two American presses which are following this practice.

R. M. Strong

SCIENTIFIC BOOKS

MATHEMATICS

Basic Mathematics for Pilots and Flight Crews. By C. V. Newsom and Harold D. Larsen, University of New Mexico. vi + 153 pp. New York: Prentice-Hall, Inc. 1943. $1.50.

This is a brief presentation of those parts of geometry, algebra and numerical trigonometry needed by members of the air force. The authors have kept in mind the recommendations of the Civil Aeronautics Administration, as well as the specific weaknesses in mathematics found by air force instructors. A review of arithmetic is included, and such topics as graphs, scales and measurement and vector diagrams are stressed. The principles of straight and circular slide rules are explained. There are a large number of practical problems, most of which will directly appeal to the student as related to aeronautics. The book seems well suited for use as a textbook for pre-flight preparation at the high-school level either in the classroom or through home study.

Analytic Geometry. By Edward S. Smith, Meyer Salkover and Howard K. Justice. University of Cincinnati. xii + 298 pp. New York: John Wiley and Sons, Inc. 1943. $2.50.

This text gives an extended treatment of plane analytic geometry, including chapters on higher plane curves, polar coordinates, parametric equations and empirical equations, followed by a brief treatment of solid analytic geometry. A short chapter on plane sections of a right circular cone, in which the fundamental properties usually taken as definitions are geometrically derived, precedes the discussion of the different types of conics. In this chapter, as well as in those on solid geometry, the figures are not only mathematically correct, but carefully designed to suggest the proper spatial relations. The authors have shown good mathematical judgment in avoiding incorrect statements, and sound pedagogical judgment in their selection of topics and omission of certain fine points. For some complicated proofs the student is referred to an outline in an exercise. The book covers competently the content of the conventional freshman course in analytic geometry, including ample material for the ablest students, and compares favorably with existing text-books in this field.

Differential Equations. By HARRY W. REDDICK, the Cooper Union School of Engineering. ix + 245 pp. New York: John Wiley and Sons, Inc. 1943. $2.50.

BESIDES most of the standard methods of solving ordinary differential equations, this text includes a chapter on power series solutions. Many of the worked problems and numerous exercises deal with physical and engineering applications, including full numerical data. The explanations are given in more detail than is often the case. The author's interest in technical applications leads him to discuss linear equations with constant coefficients immediately after equations of the first order, and to omit envelope problems and singular solutions. The book is suitable for the peacetime undergraduate course in differential equations, and just now may prove useful in some of the army training courses which devote a few weeks to differential equations and their technical applications.

Plane and Spherical Trigonometry with Four-place Tables. By WILLIAM C. BRENKE, University of Nebraska. x + 269 pp. New York: The Dryden Press. 1943. $1.90.

THIS revision of an earlier text-book includes all the traditional contents of courses in plane and spherical trigonometry with applications to surveying and navigation, as well as several additional topics. Thus there is a chapter on vectors and one on the mil and its use in artillery problems. A three-place table of functions of angles in mils is given. The four-place tables include a table of haversines, as well as those usually given. Computation by logarithms is explained in an appendix, but there is no reference to use of the slide rule. The treatment throughout is clear and comprehensive. The book should prove useful as a text in many of the courses now taken by civilians or service men.

PHILIP FRANKLIN

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

PHOTOGRAPHIC REPRODUCTION

Principles of Photographic Reproduction. By CARL W. MILLER. New York: The Macmillan Company. xii + 353 pp. 132 figs. 1942. $4.50.

"PROBABLY no one will read this book who has not spent many hours with photographic manipulation and who does not covet the opportunity to spend many more."

Thus, in the preface, does Dr. Miller warn that his book is not one for the beginner in photography. On the other hand, this does not mean that the book throughout is highly technical and abstruse—understandable only to those who have spent years in photographic research.

Among men of science, there are many to whom photography is a hobby as well as a useful tool. To them the general processes of exposure, development and printing, both by projection and contact, are entirely familiar, but perhaps some of the more advanced methods are mysteries. To such persons, who would naturally want a work thoroughly scientific in its treatment, Dr. Miller's book should be most welcome.

The arrangement of the book is a logical one. There are three main parts; the first on drawing, the second on gradations, the third on color. The part on "Drawing," concerned with the way in which the image of the scene or object is produced, starts with the lens itself. Then come chapters on the size, location and brightness of the image, on supplementary lenses, perspective, depth of focus and the arrangement of subject material. The latter is an excellent simple account of the basic principles of composition, a subject with which the scientist-photographer might be least familiar.

The camera obscura yielded images long before there was any photography. The image must be perpetuated, and that is the subject of part two—"Gradations." After chapters on exposure and development, the print is discussed. The limitations of chloride and bromide printing papers lead naturally to means for individual control and then to such processes of the expert as platinotype and palladiotype, carbon, oil, gum, carbro and bromoil. The final chapter of this section is concerned with the preparation of transparencies and lantern slides, with which beautiful naturalness can be secured.

The third and last part deals with color—first the problems of representing color in monochrome, then of reproducing color itself, both by additive and subtractive methods. In the chapter on subtractive color photography, "because of the greater economy of thought in visualizing color processes and the ease with which essential calculations can be carried through," the matrix algebra is introduced. Enough explanation is given to acquaint the reader possessed of some mathematical background with its use.

Methods of making three-color separation negatives and of printing them, multilayer films (*e.g.*, Kodachrome and Agfacolor) and the use of masking and other refinements in the precision reproduction of color occupy most of the concluding chapters.

In case the book is to be used as a text in a course in advanced photography, a number of problems are contained in the appendix. These will also be useful for the person using it in self-study, particularly as the answers are given. Four-place logarithms and anti-logarithms are included as well as a table of weights and measures, references to the literature and a complete index. At the end of each chapter where photographic processes are discussed there is a formulary, giving the recipes for the various developers, toners, intensifiers, bleachers, etc.

Finally, the illustrations should be commended. Many of these clearly show the techniques described in the text. Scattered throughout there are also a number of beautifully reproduced examples of the photographic art, some in color. Since these are not credited to any photographer, they are presumably the work of the author himself. As such they demonstrate that he can apply these methods as skillfully as he can write about them.

James Stokley

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

RESOLUTION OF THE COUNCIL ON THE SCIENCE MOBILIZATION BILL (S.702)

There is now pending in the United States Senate the Kilgore Bill (S.702), entitled "A bill to mobilize the scientific and technical resources of the Nation, to establish an Office of Scientific and Technical Mobilization, and for other purposes." This pending bill is so sweeping in character and will affect science and scientists in so many ways that it merits careful consideration by the American Association for the Advancement of Science, the most broadly representative scientific organization in the United States. In examining the purposes and provisions of Bill S.702 it will be convenient to follow the 12 sections into which it is divided, and to point out which of the provisions are to be effective in time of peace as well as in time of war.

Section 1 recites, first, the reasons for the bill, effective both in time of war and in time of peace. In enumerating the "serious impediments" to the "full development and application of the Nation's scientific and technical resources," the bill uses such terms as "unassembled and uncoordinated state of information," "unplanned and improvident training, development, and use, of scientific and technical personnel . . .," "delay and ineffectiveness in meeting urgent scientific and technical problems. . . ."

As to information about scientists, it is always available in the membership lists of scientific societies in every special field to a total of more than 500,000 names, in the membership list of the American Association for the Advancement of Science (25,000), in "American Men of Science" (28,000) and in the National Roster of Scientific and Specialized Personnel (500,000). As to information about scientific work, scores of scientific journals covering together every important field of science are published regularly in the United States. Moreover, abstracts and reviews of practically all the current literature of the world are available in a number of such publications as *Biological Abstracts* and *Chemical Abstracts*, each of which publishes about 25,000 abstracts annually.

As to "delay and ineffectiveness in meeting urgent scientific and technical problems," in 1863, at the instance of scientists of the United States, the National Academy of Sciences was established by an act of Congress which provided that the academy shall, without conpensation, advise the Government on scientific questions, an obligation that the academy has unfailingly fulfilled. The first world war began in August, 1914. Although President Wilson enjoined the citizens of the United States to remain strictly neutral in thoughts as well as in acts, in May, 1915, leading scientists of the country, realizing the nature of the storm in Europe, began to organize the scientists of the nation for service to the Government on a more comprehensive scale than could be provided under the limited membership of the academy. In March, 1916, a year before this country entered the war, President Wilson established the National Research Council by Executive Order as an agency of the National Academy of Sciences. It promptly effected an organization and prepared to respond to any calls the Government might make on scientists. The contributions of the National Research Council to the war in 1917–18 and to the national welfare during all the intervening years to the present have been enormous. It is now serving the Government through about 200 committees composed of more than 1,000 scientists. On June 28, 1941, President Roosevelt established by Executive Order the Office of Scientific Research and Development, completely under the administration of scientists. It has formulated plans for research on war problems and entered into contracts with university, research organizations and industrial laboratories which have entailed an expenditure of $188,000,000, all on a non-profit basis. The products resulting from these researches have been ordered through regular governmental channels under contracts amounting to $2,000,000,000. All this has been accomplished without discord, reorganization or the necessity of executive intervention. In addition to these activities, the principal scientific societies have appointed special committees for the investigation of war and defense problems in their respective fields and through which governmental agencies at any time can promptly obtain scientific information and competent personnel. In the face of such achievements the words "delay and ineffectiveness in meeting urgent scientific and technical problems" in Section 1 of S.702 are not appropriate.

Section 1 contains also a declaration of policy, using such terms as "appraise," "mobilize," "assemble," "coordinate," "promote," "aid," "encourage," "discover and develop substitutes," "promote interest in scientific and technical education," "provide guidance," "standardize" and "establish a national scientific and technical office." These words express worthy objectives. But these objectives have already been realized by science and technology to such an amazing degree that within a century living conditions have been more completely changed than in the preceding thousand years.

Section 2 defines terms used in the act. "Scientific and technical facilities shall include all real and personal property, . . . programs, projects, . . . methods, processes, procedures, . . . patents, inventions, . . . information or knowledge of every description used or intended to be used for scientific or technical purposes in research and development or in the production or supply of war or civilian goods or services." "Scientific and technical personnel shall include all persons, excepting physicians and dentists, who have completed any course of study in any college or university in any branch of science or its practical application or who have had not less than an aggregate of six months' training or employment in any scientific or technical vocation." "Agency or establishment" means any Federal or State agency or other body or any "local government, person, firm, or partnership engaged in business for profit, or any corporation, profit or nonprofit, association, school, college, and university." In short, "scientific and technical facilities," as used in S.702, includes every means useful in any way for the production of "war or civilian goods or services"; "scientific and technical personnel" includes every person, except physicians and dentists, who has completed a college course in any branch of science or who has been employed for six months on any kind of work that may be called technical; and "agency or establishment" includes every agency, corporation, person, partnership, association, school, college and university, whether or not organized for profit and whatever its purposes or activities may be. It would be difficult to make more inclusive definitions. Moreover, in giving to an agency under the President powers over broadly general things the act violates the spirit of the Federal Constitution which grants powers over specific things to the Federal Government and declares that those not so delegated nor prohibited by it to the States "are reserved respectively, to the States or the people."

Section 3 defines the organization of the "Office of Scientific and Technical Mobilization." It is to be under the direction of an "Administrator" appointed by the President to serve at the pleasure of the President, and of a salaried "National Scientific and Technical Board," also appointed by the President, but whose duties are to be defined by the Administrator. This Board is to consist of six members, besides the Administrator, one to represent industry, one to represent agriculture, one to represent labor, one to represent the consuming public and "two additional members at large who shall be scientists or technologists." By previous definition in the bill, to be classed as a scientist or a technologist it is sufficient to "have had not less than an aggregate of six months' training or employment in any scientific or technical vocation." The Administrator will appoint all other employees, and he may waive the provisions of the civil-service laws and regulations if he determines it is necessary to do so.

Provision is made also for a non-salaried "National Scientific and Technical Committee," consisting of the Board previously mentioned, a representative from each of such Federal departments as the President shall designate, four additional representatives of the consuming public, six additional members representing labor, six representing management (including small business) and three additional scientists or technologists. That is, the Technical Committee will consist of twenty-five to thirty members, of whom five must be scientists or technologists in the sense that each of them shall "have had not less than an aggregate of six months' training or employment in any scientific or technical vocation." This committee is to be appointed by the President to advise and consult with the Administrator at least once a month upon basic policies of the Board.

In order that it might reasonably be hoped that any considerable fraction of the purposes of the act, as set forth in the latter part of Section 1, might be realized it would be necessary that the Administrator and the Board be men of the highest integrity, ability, experience in science and devotion to public welfare. Instead of insuring that the Board shall have these essential qualities the act provides for a primarily political Board of seven members, only five of whom need be scientists or technologists even in the extraordinary sense in which the term "scientific and technical personnel" is defined in Section 2.

Section 4 defines the powers of the proposed Office, effective in times of peace and of war. Blanket authority is given for many purposes, including the powers to formulate, finance, control, contract for and operate all undertakings or projects that the Administrator shall determine fall under the broadly inclusive definitions of "scientific and technical facilities," "scientific and technical personnel" and "agency or establishment" previously given. This section explicitly provides that these sweeping powers are to be exercised in accordance with rules and regulations prescribed by the Administrator and that they "shall have the force and effect of law" of Congress. That is, in passing this act the Congress would delegate to the Administrator appointed by the President law-making powers, relative to this subject, that are vested, in general, in the Congress by the Constitution of the United States.

Section 5 transfers to the Administrator, by amending the Selective Training and Service Act of 1940, control over the deferment from military service of persons who, under the definitions of the act, are classed as "scientific and technical personnel." In view of the inclusive definition of "scientific and technical personnel," this provision would seriously impair the functioning of the already complex manpower control machinery.

Section 6 gives the Administrator, in time of war, the right to requisition, subject only to review by the President, the stupendous means of production that, under the act, are classified as "scientific and technical facilities," and to represent before the War Production Board "any application for allocation of, and priority for, any critical material and equipment in scientific and technical research and development." The exercise of such a power would severely handicap the functioning of such efficiently managed and highly successful agencies as the Office of Scientific Research and Development, referred to in comments on Section 1.

Section 7, "any provision of law to the contrary notwithstanding," vests the Office with "the exclusive right to use, and with the exclusive right to license others to use, (1) any invention, discovery, patent or patent right which has heretofore resulted, or shall hereafter result, from research or invention for the carrying on of which the United States or any department, agency or establishment thereof either has heretofore contributed at any time since the declaration of national emergency on May 27, 1941, or shall hereafter contribute any money, credit, physical facilities or personnel; and (2) any invention, discovery, patent, or patent right which is at the time of the enactment of this act, or shall hereafter become, to any extent the property of the United States or of any department, agency or establishment thereof." These broad powers are vested in the Office however small the contribution by the Government or a governmental agency may have been. The Administrator is "authorized and directed to prescribe and promulgate rules and regulations which shall thereupon have the force and effect of law for the enforcement of the provisions of this section, . . ." This delegation of power giving the Office the exclusive right to use patents and to license others to use them opens the door to abuse in time of peace and adds nothing to the powers of the Government in time of war.

Section 8 gives the Administrator the power to require all information he may desire "concerning scientific and technical facilities during the existence of a state of war and concerning scientific and technical personnel at all times." "Any person or establishment [possibly a university] refusing or wilfully failing to furnish the . . . shall, upon conviction thereof, be fined not more than $5,000 or imprisoned for not more than one year, or both."

Section 9 authorizes the appropriation of $200,000,000 to carry out the provisions and purposes of the act. This section also authorizes the Administrator to organize corporations and to make loans to, or purchase all or part of the capital stock of, corporations whenever he deems it necessary to do so for the more effective exercise and performance of his own powers and duties or of those of the Office. The appropriation provided would be wholly inadequate for the purposes set forth.

Section 10 gives the Administrator important powers usually lodged in courts, and it provides that "any person who wilfully violates any order, rule or regulation promulgated by the Administrator under the authority of this act shall, upon conviction thereof, be fined not more than $5,000 or imprisoned for not more than one year, or both." In giving the Administrator, a representative of the President, quasi-judicial powers the act departs from the distribution of legislative, executive and judicial powers as defined in the Constitution of the United States.

Section 11 requires the Administrator to render annually to the President and to Congress a written report, summarizing the activities of the Office and the status and progress of science affecting the public interest.

Section 12 provides that if any clause, sentence or paragraph of the act is invalidated by any court action it shall not affect the validity of the remainder of the act.

After careful consideration of the purposes and provisions of the Science Mobilization Bill (S.702), the American Association for the Advancement of Science, an organization having nearly 25,000 members (and having 187 associated and affiliated societies with a combined membership of over 500,000 persons whose interests cover broadly all the natural and social sciences) now, through its Council of about 250 members chosen from among the leaders of American science, respectfully recommends to the Senate and to the House of Representatives of the United States that the Kilgore Bill (S.702) be not passed either in its present form or in any other form containing similar provisions.

SPECIAL ARTICLES

ENHANCEMENT OF LEUKEMOGENIC ACTION OF METHYLCHOLANTHRENE BY PRE-IRRADIATION WITH X-RAYS[1]

LEUKEMOGENIC agents to which man is exposed are numerous, and it is of great interest to find out if one such agent can prepare the soil for or enhance the action of another.

TABLE 1

INCIDENCE OF LEUKEMIA IN MICE TREATED WITH METHYLCHOLANTHRENE OR X-RAYS OR BOTH

Treatment of mice	Experiment 1			Experiment 2			Total			
	No. used	No. +	No. alive at 10–16 mo.	No. used	No. +	No. alive at 10–16 mo.	No. used	No. +	Per cent. +	No. alive at 10–16 mo.
X-ray, 175 r	18	1	16	..	..	..	18	1	6	16
Painting with methylcholanthrene	21	5	7	16	1	7	37	6	16	14
X-ray and painting with methylcholanthrene	19	11	5	17	12	5	36	23	64	10

X-rays are mildly leukemogenic.[2, 3] Moderate and large doses rapidly destroy blood-forming organs, but if x-ray action is discontinued, regeneration follows within a few days, and during this phase mitotic figures are seen in abundance in sections of blood-forming organs. It seems probable that during this phase blood-forming organs would be particularly susceptible to leukemogenic irritants.

To test this possibility, thirty-six mice of four to six weeks of age were irradiated with 175 r over the entire body. These mice were painted with methylcholanthrene, beginning the day following the irradiation. The technic of irradiation of treatment with methylcholanthrene has been described.[4] In addition, thirty-seven mice were painted but not irradiated, and eighteen mice were irradiated but not painted. The results are given in Table 1.

The figures indicate that pre-irradiation greatly enhances the susceptibility of mice to the leukemogenic action of methylcholanthrene. In addition, pre-irradiation hastens the onset of leukemia, as shown in Fig. 1.

According to more extensive, earlier work,[5] spontaneous leukemia occurs in about 11.6 per cent. of this genetically uniform stock (Rf/Ak), but the onset of illness is seldom if ever noted before the age of seven months. Preceding the current experiments the incidence of leukemia was again determined in both irradiated and non-irradiated mice of this stock (Table 2).

In this test the incidence of spontaneous leukemia in the stock used (Rf/Ak) was even slightly lower than noted before, but that among the x-rayed mice was fairly high. However, in this experiment 300 r of x-rays were used, while in that recorded in Table 1, 175 r were used. Moreover, the disease in these mice occurred at a later period than in those exposed to methylcholanthrene. The two control mice died of leukemia at twenty-one months of age, one of the x-rayed mice at five, the others at eight to seventeen months of age.

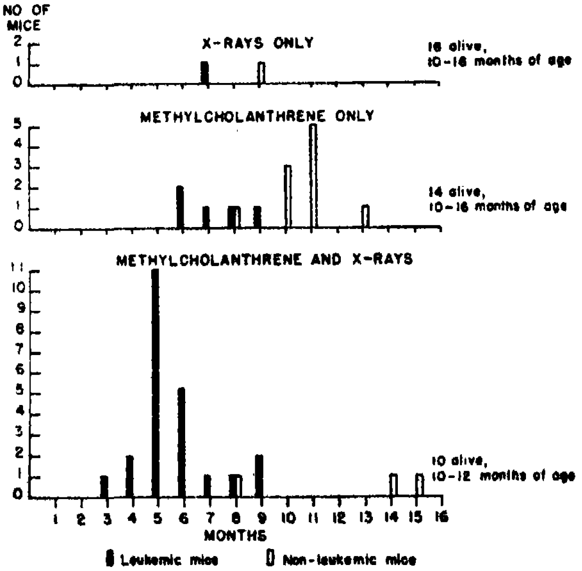


FIG. 1. Time of occurrence and frequency of leukemia in mice treated with methylcholanthrene or x-rays or both.

TABLE 2

	No. in group	No. +	Per cent. +
Irradiated mice (300 r) ..	17	10	59
Non-irradiated control	25	2	8

These findings can be explained in several ways. According to the supposition that seems most probable, the neo-plastic transformation of lymphoid cells is brought about by methylcholanthrene, while the derangement that follows irradiation prepares (sensitizes) them for the action of methylcholanthrene.

---

[1] This study has been supported by the Jane Coffin Childs Memorial Fund for Medical Research, the International Cancer Research Foundation, the Lady Tata Memorial Trust and the Anna Fuller Fund.

[2] C. Krebs, H. C. Rask-Nielsen and A. Wagner, *Acta Radiol. Suppl.*, 10: 1, 1930.

[3] J. Furth and O. B. Furth, *Am. Jour. Cancer*, 28: 54, 1936.

[4] D. P. McEndy, M. C. Boon and J. Furth, *Jour. Nat. Cancer Inst.*, 3: 227, 1942.

[5] R. K. Cole and J. Furth, *Cancer Res.*, 1: 957, 1941.

Results similar to those described above have already been noted in experimental studies on the production of skin tumors. Mottram[6] found that painting mice with 3:4 benzpyrene and irradiating them on the sixtieth day with a dose of 176 to 1,584 r gamma radiation produced both benign and malignant tumors of the skin. No tumors followed painting for the same period without irradiation. Similar results were obtained by Mayneord and Parsons[7] by the combined application of x-rays and a different carcinogen. They observed that irradiated and painted mice developed sarcomas at an earlier date and in greater numbers than the non-irradiated mice. Gilmour[8] obtained similar results by the combined application of estrone and 3:4 benzpyrene. The follicular sex hormone alone did not produce cutaneous tumors.

These observations indicate that subthreshold doses of different carcinogens may summate, or that one may sensitize tissues for the action of the other. The essential similarity of leukemia and accepted types of cancers is again emphasized by these experiments. The same agents differently spaced and dosed may produce either predominantly leukemia or the more accepted types of cancers. The mechanism of summation of carcinogenic stimuli deserves further experimental study.

CONCLUSION

Both x-rays and methylcholanthrene are leukemogenic. The leukemogenic action of small doses of methylcholanthrene is greatly enhanced by pre-irradiation with doses of x-rays which alone rarely produce leukemia. The leukemogenic action of x-rays is milder than that of methylcholanthrene and affects a smaller number of mice after a longer period of latency.

J. FURTH
M. C. BOON
CORNELL UNIVERSITY MEDICAL COLLEGE,
NEW YORK HOSPITAL

THE COMPARATIVE NUTRITIVE VALUE OF BUTTER AND SOME VEGETABLE FATS[1]

IT has been generally accepted by nutritionists that, aside from differences in vitamin potencies, all fats have essentially the same nutritive value. An exception to this is the specific rôle played by those fats which contain certain unsaturated fatty acids.[2] Schantz *et al.*[3] have recently postulated that butter is more effective than vegetable oils in producing growth in weanling rats presumably due to long chain saturated fatty acids, although in a recent report the superiority of butter over corn oil was observed only when the dietary carbohydrate was lactose while conditions were reversed when carbohydrates other than lactose constituted the carbohydrate portion of the diet.[4]

We have followed the rate of growth of 21-day weanling rats for six or 12 weeks on diets composed of 68 per cent. of mineralized skim milk powder and 32 per cent. of the fat under study with supplements of vitamins A (as carotene and A), D and E added to the fats. Corn, cottonseed, olive, peanut and soybean oils were tested as well as butter and vegetable margarine fat. In one series where vegetable margarine fat and butter fat only were compared over a six-week period no differences in growth rate were noted. A total of 46 male rats and 89 female rats were used in these tests. In series II, where groups of approximately 15 male and 15 female rats were fed for 12 weeks diets containing each of the seven fats listed above, no differences were found in the growth at three or six weeks or with the males at 12 weeks. The female rats receiving the butter diet weighed slightly more at 12 weeks, but the difference was not significant statistically. However, in series III where diacetyl was added to the vegetable fats in an amount of 4 parts per million, no differences of weight were noted at any interval either in the males or females. The same number of rats was used as in series II. Not only was the growth rate identical as demonstrated by body weight but bone growth was also equal as found by x-ray measurements of tibia length at the end of three and six weeks on the respective diets. Also no significant differences were obtained in the water, protin, lipid, ash and calcium content of the rats which had received the various diets for 12 weeks. This would prove that the equal growth was actually due to similar tissue growth.

One explanation for the discrepancies between our results and some of those where *ad lib.* feeding is employed[3] is in all probability to be traced to the fact that weanling rats prefer a butter flavor and will eat more of such a diet. In experiments where the rats had a choice of a diet containing margarine fat or peanut oil with or without diacetyl, the rats ate more of the diacetyl-containing diets 18 times and of the unflavored diets in only one instance. Also in tests on twelve weanling rats carried out over 12 weeks, where both an unflavored peanut oil diet and one containing commercial butter flavor[5] were offered the rats, a decided preference was invariably shown for the flavored diet by eight of the rats, while almost equal quantities of the two diets were consumed by the other four rats. In no single case is there any evidence of a preference for the unflavored diet.

---

[6] J. C. Mottram, *Am. Jour. Cancer*, 30: 746, 1937.

[7] W. V. Mayneord, L. D. Parsons, *Jour. Path. and Bact.*, 45: 35, 1937.

[8] M. D. Gilmour, *Jour. Path. and Bact.*, 45: 179, 1937.

[1] This work was carried out under a research grant from The Best Foods, Inc.

[2] G. O. Burr and M. M. Burr, *Jour. Biol. Chem.*, 82: 345, 1929; 86: 618, 1930.

[3] E. J. Schantz, C. A. Elvehjem and E. B. Hart, *Jour. Dairy Sci.*, 23: 181, 1940.

[4] R. K. Boutwell, R. P. Geyer, C. A. Elvehjem and E. B. Hart, *Jour. Dairy Sci.*, 26: 429, 1943.

[5] Verley "B F A."

These experiments indicate that on an adequate vitamin intake the fats studied are of equal nutritional value for growing rats. They explain how the greater growth of weanling rats on a butter diet in experiments where *ad lib.* feeding is employed may result simply from a greater food consumption due to the preference of rats for butter flavor. Diets containing all these fats were used with equal efficiency in transformation to body tissue.

Harry J. Deuel, Jr.
Eli Movitt
Lois F. Hallman
University of Southern California
Medical School

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE AND EFFICIENT CALOMEL HALF CELL

Some fifteen years ago a co-worker was told to prepare a calomel half cell using a glass filter tube on the end of the siphon connecting the cell and the analysis vessel. He covered the glass filter plate with the mercury, added the calomel and the KCl solution and inserted this electrode directly into the analysis vessel. Evidently, as he stated afterwards, he had suffered from temporary absence of mind, for that electrode could not be expected to work. But the half cell too was absent-minded: it worked. The thin moisture layer on the glass surface was sufficient to form a conductive bridge between the calomel-KCl suspension above the mercury and the filter plate below it.

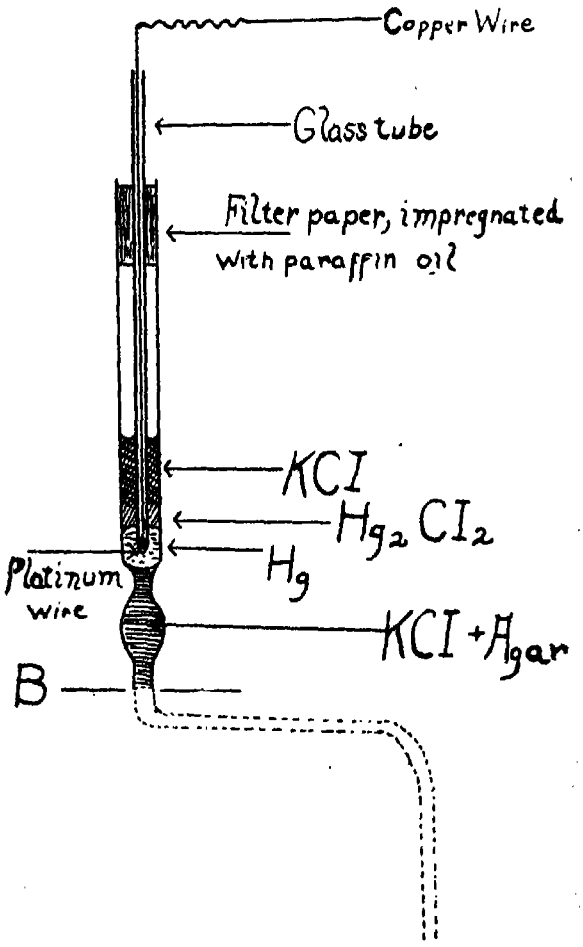


FIG. 1

I remembered this fact later when needing a standard half cell, but lacked the usual implements to construct it and had not the possibility of acquiring them. Here it is (see Fig. 1); it needs only 0.5 ml of mercury, works perfectly and may be useful in teaching and research laboratories. The half cell may be inserted in a flask containing an indifferent solution and connected with the analysis vessel by a siphon; in this case its end (B) may be closed by agar or by a stopper of cotton or filter paper.

To be introduced directly into the analysis vessel, the bottom end has the form indicated by the dotted trace.

F. L. Hahn
Instituto Químico-Agrícola Nacional,
Guatemala, Guatemala, C. A.

BOOKS RECEIVED

Cobb, Stanley. *Borderlands of Psychiatry.* Harvard University Monograph in Medicine and Public Health Number 4. Illustrated. Pp. xiv + 166. Harvard University Press. $2.50.

Degering, Ed. F. *An Outline of the Chemistry of the Carbohydrates.* Illustrated. Pp. viii + 474. John S. Swift Co. $6.00.

Dodge, Bernard and Harold W. Rickett. *Diseases and Pests of Ornamental Plants.* Illustrated. Pp. xi + 638. The Jaques Cattell Press. $6.50.

Grant, J. C. Boileau. *An Atlas of Anatomy.* Volume 1. Illustrated. Pp. xv + 214. Williams and Wilkins Company. $5.00.

Harrell, Ruth Flinn. *Effect of Added Thiamine on Learning.* Pp. v + 55. Bureau of Publications, Columbia University. $1.75.

Schopfer, W. H. *Plants and Vitamins.* Illustrated. Pp. xiv + 293. Chronica Botanica Co. $4.75.

Strong, Oliver S. and Adolph Elwyn. *Human Neuroanatomy.* Illustrated. Pp. x + 417. Williams and Wilkins Co. $6.00.

Woods Hole Oceanographic Institution. *Collected Reprints.* 1942.

SCIENCE

VOL. 98 FRIDAY, AUGUST 13, 1943 No. 2537

Marine Biological Laboratories: DR. THOMAS BARBOUR 141

The Number of Scientific Men Engaged in War Work: DR. LEONARD CARMICHAEL 144

Obituary:
William Shirley Bayley: DR. M. M. LEIGHTON. *Recent Deaths* 145

Scientific Events:
Industrial Research in Great Britain; The Wartime Conference of the American Public Health Association; Appeal of the War Policy Committee of the American Institute of Physics; The Office of Scientific Research and Development; Manpower Problems in the Chemical Industry 146

Scientific Notes and News 149

Discussion:
The Science Mobilization Bill: SENATOR HARLEY M. KILGORE. *Salmon Conservation:* DR. GEORGE A. ROUNSEFELL. *Transliteration Once More:* PROFESSOR PAUL HANLY FURFEY. *Suggested Change in Designation of "Renin-Activator" (Hypertensinogen) to Renin-Substrate (α_2 Globulin):* DR. IRVINE H. PAGE and OTHERS 151

Scientific Books:
Three Mathematical Text-books: PROFESSOR C. N. MOORE. *Biochemistry and Morphogenesis:* PROFESSOR DOUGLAS WHITAKER 154

Special Articles:
Thiouracil in the Treatment of Thyrotoxicosis: DR. ROBERT H. WILLIAMS and DR. GROSVENOR W. BISSELL. *Effect of Various Chemical Agents Affecting Permeability of the Mucosa on the Formation of Ulcers:* DR. R. L. DRIVER, G. S. DOZIER and H. C. DENHAM 156

Scientific Apparatus and Laboratory Methods:
On the Staining of Yeast Spores: PROFESSOR L. S. MCCLUNG. *Enzymatic Cleaning of Berkefeld Candles Used in the Filtration of Human Blood Plasma:* DR. BERNARD WITLIN 159

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

MARINE BIOLOGICAL LABORATORIES

By Dr. THOMAS BARBOUR

MUSEUM OF COMPARATIVE ZOOLOGY, HARVARD UNIVERSITY

IN spite of the war, interest in tropical marine biology has not waned. Indeed, there are a number of problems directly connected with the war effort which can only be attacked by making use of the facilities offered by a marine biological laboratory. The Bermuda Biological Station for Research is closed for various obvious reasons. The Bermuda Aquarium continues open to the public and I see no reason why that should not be a successful enterprise for a long time to come, inasmuch as our Armed Forces to-day are helping support it by their attendance, and as soon as the war is over there is every reason to believe that Bermuda will resume its importance as a tourist center. I am proud to have had a finger in closing up the Biological Station at the Dry Tortugas, where the cost per day per investigator was something the less said about the better.

It is becoming increasingly obvious that the question of economy must be given more and more consideration as funds available for research become more and more restricted. It seems to me clear, therefore, that all our resources, both intellectual and financial, should be devoted to develop that laboratory which offers the optimum biological opportunities with the greatest accessibility, since accessibility means least transportation costs for both investigators and shipments of material. The laboratory recently opened by the University of Miami at Belle Isle, near Miami Beach, answers these requirements. The premises at present occupied by the station are temporary and rather limited in scope, but opportunity for economical expansion is right there and is assured. The director of this station is Dr. F. C. Walton Smith, whose address is care of the University of Miami, Coral Gables, Florida. I know that Dr. Smith will be glad to answer inquiries regarding facilities for research, and indeed he has prepared an excellent descriptive pamphlet outlining the extraordinary variety of environmental conditions near at hand from which I am going to quote. To all intents and purposes, the Gulf Stream is as conveniently accessible to this marine station as it was to the Dry Tortugas. Ocean beaches, mangrove swamps, wide areas of coral reefs in water sufficiently shallow so that collecting with a diver's helmet is perfectly feasible, as well as wide areas of sand flats with shallow water, are near at hand. The sea is as deep off shore as it is elsewhere and the edge of the continental shelf is not far distant.

Innumerable buses per day pass the door of the laboratory and thus metropolitan Miami may be reached in a few moments. I don't have to add that railway service and air connections link Miami with the rest of the country in a matter of hours. Thus the cost of reaching this station from any point in the United States will always be much less than reaching the station in Bermuda should it ever be reopened, and moreover, while the Bermuda fauna is tropical, nevertheless in many directions it is distinctly depauperate, as is well known. The reverse is distinctly the case with the station in Florida. Dr. David Fairchild and I visited the laboratory about two months ago. Our visit was motivated by having read "Opportunities for Subtropical Marine Investigations," issued by the university. We were astonished that right here under our very noses had been set up a laboratory which not only deserves the support of the foundations, but of all the societies associating investigators interested in this field. Besides Dr. Walton Smith, chairman of the advisory committee of the laboratory and its director, Dr. Robert H. Williams, a botanist, is assistant director. Dr. Morton Miller and Dr. Elmer Hjort are also on the staff of the station.

I quote now from the prospectus:

> The laboratory is situated upon an island of the Venetian Causeway connecting the cities of Miami and Miami Beach. This is a most convenient location for several reasons. Not only may it be reached by a ten-minute automobile drive from Miami, but public transportation services have established a passenger stop at the entrance of the grounds. The grounds themselves are a portion of a large enclosed estate so that visiting investigators may be assured of privacy. Living quarters are available adjacent to the laboratory and there are excellent hotels within walking distance. The advantages of accessibility include the possibility of obtaining supplies at short notice from chemical and other houses in Miami or from the university, situated at Coral Gables, immediately outside Miami.
>
> Although within the city limits of Miami Beach and adjacent Miami, the laboratory is conveniently located with respect to collecting grounds. On the sea-wall bordering the laboratory grounds numerous large urchins, sponges, corals, alcyonaria, oysters, and barnacles flourish and reproduce during practically every month of the year. The water in which these forms grow is pumped directly into the laboratory supply pipes without the intervention of a closed circulation system.
>
> Accommodations in the laboratory are at present sufficient for a limited number of workers only, but are so organized as to allow for considerable expansion at short notice. Individual rooms for investigators are provided in addition to the tank room with its water table. For collection from more distant grounds a fast 22-foot launch is provided. The usual collecting equipment such as dredges and tow-nets is used and, in addition, the diving helmet has been found a convenient and valuable aid in investigating bottom-living forms such as those of the coral reefs in the warm water to a depth of forty feet.
>
> Undergraduate classes in marine botany and zoology have been held in the summer school of the university, as well as in the regular semester for some years past, and these may be continued in curtailed form during the summer of 1943.
>
> For those engaged in certain fields of tropical marine investigation research grants may, under approved circumstances, be available from various sources. Further information, covering laboratory and living accommodation, may be obtained by applying to the director, giving a description of the nature of the proposed investigations and approximate duration of the visit.
>
> Within an area readily accessible to the laboratory is to be found a wide variety of habitats including shores of coral or sedimentary rock; gold and white beaches of shell and coral sand; shallow bays and inlets lined with the red mangrove, whose roots provide shelter for a varied community of plants and animals; the slimy marl or calcareous ooze, which supports the growth of commercial sponges; the outer line of reefs and the inner islands and flats, separated by the inner and outer channels from the shores; and, within a short distance from land, the deep blue waters of the Gulf Stream.
>
> The fauna consists of sub-tropical forms extending north from Miami, together with numerous tropical species which overlap and find their northern limit in this latitude. Conspicuous among the latter are the massive reef building corals and the smaller inshore forms, many of which, like *Isophyllia, Oculina* and *Meandrina*, may be kept alive in the laboratory for considerable periods, and which are therefore well adapted for experimental work. No less interesting are the massive brain corals such as *Diploria, Montastrea* and *Dichocoenia*. Not only are these corals interesting in themselves, but they provide a shelter for calcareous tube-worms, boring molluscs and crustacea, and house in their crevices many brittle stars and occasional burrowing holothurians. One of the interesting inhabitants is the Atlantic palolo-worm, *Eunice fucata*, which liberates its reproductive segments in swarms to the surface of the ocean in an annual rhythm, the climax of which occurs at the corresponding tide and season each year.
>
> A large and important group are the alcyonaria. Large groves or underwater shrubberies of these fans and whips are found in shallow water, and are associated with

sponges, holothurians, six-rayed stars, basket stars and various tropical mollusca.

The echinoids are plentiful and include *Lytechinus variegatus*, which litters the offshore flats, and *Centrechinus*, whose egg should interest embryologists. Sand-dollars, heart-urchins and the beautiful golden *Moira atropos* from muddy bottoms are also common. The stars range from the large *Oreaster* to the small red *Echinaster*. Below the surface of sand lives the handsome *Luidia*. All three are very plentiful.

Some of the larger crustacea live in holes or burrows, as in the case of the stone-crab and the "sand-lobster," *Scyllarides equinoctalis*. The Florida crayfish, *Panulirus*, is plentiful and is remarkable for its unusual breeding habits. There are numerous species of the smaller crustacea.

Clumps of *Sargassum* weed which drift inshore in quantity afford startling illustrations of protective mimicry in their associated nudibranchs, crabs and fish.

A particularly rich habitat is that of the piling and wharf. Coelenterates, sponges, bryozoa, tunicates and barnacles are easily collected without leaving the laboratory grounds, by means of devices developed by recent investigators, and they afford a splendid opportunity for the study of the previously rather neglected field of the biology of sedentary and fouling organisms.

The large loggerhead sponge forms a habitat in itself, supporting the growth of an enormous variety of commensals including annelids, crustacea, gastropods, coelenterates, tunicates and even barnacles.

Fishes of southern Florida exist in enormous variety and range from the marlin and sailfish down to the delicate blue-heads and multicolored inhabitants of the reef, which are equally numerous in variety and quantity. Among the mammals are porpoises and the vegetarian sea-cows.

The great variety of animals is equalled by the abundance of algae which, together with some marine seed-plants, flourish in this region. Among the latter are *Thalassia*, *Cymodocea* and *Halodule* which replace the familiar eel-grass of northern waters.

Blue-greens are abundant in the brackish water along the canals draining the Everglades area, and in the tidal pools filled with decaying vegetation.

Green algae show more coenocytic forms than are found in more temperate zones. The delicately beautiful *Acetabularia* and the bushy *Batophora* are among the most common of the littoral greens. The Valoniaceae are well represented by the beautiful *Anadyomene* and *Dictyosphaeria* and by several species of *Valonia*, which lends itself so well to physiological studies. The Codiaceae are very abundant, especially the lime-encrusted *Halimedas*, *Penicillus*, and others which almost cover some areas of shallow water. The Caulerpaceae include eleven or more species of the fascinating fern-like Caulerpas.

Although no massive browns of the Laminariales occur here, there are several attached and floating species of *Sargassum* and other Fucaceae, along with the well-known Dictyotas, *Zonaria* and *Padina*.

The red algae are amazing in their numbers, variety and beauty, becoming a delight to the collector and a challenge to the taxonomist. From the delicate Bangiales, to the lime-encrusted *Corallinas* and the tiny *Ceramiums*, every order is well represented. There are at least twenty-three genera of Rhodomelaceae, ten of Ceramiaceae. Many are easily collected at low tide, some are dredged, and many more are washed near or on shore in the drift. The delicate *Dasya* flourishes near the spiny *Acanthophoras* and *Digenia*. Many square miles of the shallow bays are covered with species of reds, some of which may prove commercial sources of agar.

The algologist will find in South Florida the materials, habitats, and equipment for a wide variety of physiological, taxonomic and ecological investigations.

I do not think that anything more need be said to prove my point. Not long since I had the pleasure of making a little address, presenting the Alexander Agassiz Medal of the National Academy of Sciences to Columbus O'D. Iselin. To my delight, I found, conversing with him, that he had visited this station very recently and was as completely convinced of the excellence of the opportunities presented as I was. I feel quite sure that he would endorse all the statements which I have made. Many persons forget that some years ago a most excellent marine aquarium was opened at Miami, not far from where the station is located. Were it open to-day it would be self-supporting. It would have still been open to-day except for the fact that the property on which it was situated became so extremely valuable that the institution simply could not continue operations. Those boom days are past and the area has shaken down now, so that there is little reason to believe that financial convulsions causing sudden fluctuations in land values will be likely to occur in the future. Rebuilding and reopening the aquarium with the idea of its being supported by admission fees to be paid by the public would be a useful adjunct to the station and a great addition to the educational and entertainment resources of the area. I believe that this is certain to come in the future. In the meantime, to all American biologists interested in opportunities to conduct investigations in marine zoology or physiology and assorted disciplines, here is the answer to prayer.

I hope that Dr. Walton Smith will not object to my interjecting myself into his affair in this way. The sooner, however, that this matter begins to be talked about and the sooner these opportunities are appreciated, the sooner will adequate financial support come forward to aid this project. There is no reason to reopen the Bermuda station and certainly no object in opening another tropical station for North American biologists.

THE NUMBER OF SCIENTIFIC MEN ENGAGED IN WAR WORK

By Dr. LEONARD CARMICHAEL

DIRECTOR OF THE NATIONAL ROSTER OF SCIENTIFIC AND SPECIALIZED PERSONNEL AND PRESIDENT OF TUFTS COLLEGE

A NUMBER of statements have appeared attempting to estimate the total number of scientific men employed in the war effort. A request has been received in the office of the National Roster from the editor of SCIENCE requesting a statement on this matter.

In the opinion of the staff of the National Roster, no satisfactory quantitative statement can be made concerning this question because any one numerical answer given will be almost entirely a function of the definition of the term "scientific man" adopted and of some other special assumptions. For example, are all physicians, dentists, veterinarians, pharmacists and osteopaths scientific men? Are social scientists as a group or are only certain social science areas to be included? Are all individuals who are now living who are known to be graduates of accredited institutions with degrees in engineering or science to be considered as scientists no matter when the degrees were received or what the present occupations of the individuals in question may be?

If the medical sciences and the social sciences are eliminated, the best estimate that the Roster has been able to bring together is that there are between 400,000 and 500,000 trained or qualified scientific men and women in the country. If we take certain typical professions, such as segments of the engineering profession and of chemistry, in which we have some satisfactory empirical data, there is reason to believe that over three fourths of this total number may be formally described as engaged directly or indirectly in war work. This estimate, of course, includes those who are in the Army and Navy and who use their scientific training not necessarily in the scientific specialty for which they were prepared but who are using mathematics and other tool subjects in special military tasks. It must be pointed out that of the scientists not actively engaged in war work many are overage, physically incapacitated or for personal reasons not available for scientific work.

A typical example of the difficulty of making an estimate of the number of scientific men in war work may be found in an illustration from the field of physics. Experience of the National Roster indicates that the physicists of the country are as well organized, if not better organized, than any other professional scientific group. It is also probably true that the National Roster has more complete records concerning the members of the profession of physics than in any other field. From the first, however, the physicists themselves have found it difficult to establish a fully satisfactory definition of what constitutes a physicist. A minimum definition of a professional physicist has been presented by the physicists as an individual with at least a master's degree or one possessing equivalent qualifications based on a combination of training and experience. There are somewhat more than 7,000 such men and women in America. In spite of this definition, many students with bachelor's degrees whose major work was done in physics have been employed in war research and as college teachers and as such have been treated by the National Roster as professional physicists. The total of this group, if added to the 7,000 given above, might justify the statement that there are probably 11,000 physicists. On the other hand, if the definition of scientist adopted indicates an ability to do advanced independent research, it is probable that there are not more than 2,000 or, at the most, 3,000 physicists in America. Thus the problem of definition makes it extremely difficult to answer the question, "How many scientists are engaged in war work." It may also be added that the determination of what is and what is not war work is not clearly definable and the determination made concerning this matter in one set of circumstances does not necessarily apply to some other set of circumstances. Added to all this is the further fact that a good number of scientists apportion their working time to different projects. It should also be mentioned that in spite of the fact that the Roster at one time was able to obtain the number of scientists and engineers employed in three fourths of the plants of the country engaged full or part time in the war program, it is still not easy to make any accurate guess concerning the total number of scientists actually employed in the Army, the Navy and in war industry.

Probably the most accurate statement that could be made with respect to the number of scientists engaged in war work is that the scientific and technological mobilization of our nation at war has become so complete that the services of nearly all scientific personnel in some way contribute to or support the war effort. Our colleges and their laboratories, our industries and their laboratories, and our government and its laboratories have become an integrated partnership in the prosecution of a war in which the full might of our scientific and technological capacity is brought to bear upon the enemy. Thus, when an individual scientist, without complaint and without heroics of any sort, willingly relinquishes a higher paying and more conveniently located job in order to assume a particular wartime task, his decision to transfer more often than not is based on the higher need for his services in the new undertaking rather than because of any lack of contribution to the war effort in the position vacated. To the individual scientist, the question to-day is not "where can he serve" but "where can he serve best." Cold figures can not tell this story, but the enemy has already been made to understand it.

OBITUARY

WILLIAM SHIRLEY BAYLEY

When the late William Shirley Bayley, professor of geology, emeritus, University of Illinois, graduated from the Male High School of the City of Baltimore at the age of seventeen, he was the recipient of a prize given by the Peabody Institute of the City of Baltimore "for fidelity to his studies and attainment therein, for correct moral deportment and personal habits, and for propriety of manners." A more accurate characterization of him could scarcely be written now. Some elaboration of his life, however, is quite appropriate.

He was born in Baltimore, Md., on November 10, 1861, the son of Robert P. and Emma Downing Bayley. On his father's side the family was of old Irish ancestry, and resided at Crossharm, Ireland. On his mother's side the family was English, dating back to Stephen Williams of Great Yarmouth, County Norfolk, in the sixteenth century. In 1637, Robert Williams, of the eighth generation removed, emigrated to Massachusetts, and subsequent members of his lineage filled places of trust and distinction in colonial affairs.

From high school young Bayley entered the Johns Hopkins University with a view to becoming a chemist, but he found increasing interest in the new and growing science of geology which offered opportunities for young men in both the field and the research laboratory. One time he tried to help his father out in his business of importing china, when his father was stricken with paralysis, but business life did not appeal to him and he returned to his studies. Receiving his A.B. in 1883 he continued his postgraduate studies, was awarded a fellowship in 1885–86 and received his Ph.D. degree in 1886.

From 1888 to 1904 he served as professor of geology at Colby College, where his popularity as a teacher and his devotion to research made him an inspiring faculty man. Among his students was the young George Otis Smith, who later became director of the U. S. Geological Survey. In tribute to Professor Bayley's teaching, Dr. Smith relates in the March, 1942, issue of *The Colby Alumnus* that in a Johns Hopkins laboratory in the course of his graduate work, a debate among the graduate students was closed by one of them remarking: "It isn't that 'G. O.' learned more geology in college than we did, but he didn't learn so much that wasn't so."

After teaching two years at Lehigh University, Professor Bayley was invited by President Edmund Janes James to come to the University of Illinois in 1906 where, from assistant professor of mineralogy and economic geology he rose to professor of geology in 1913 and head of the department in 1928, in which capacity he served until his retirement in 1931 with the designation of professor emeritus, thus completing twenty-four years of highly creditable service to the university. As a junior member of the department from 1919 to 1923, the present writer came to recognize his thorough-going teaching and his challenging attitude toward his students in stimulating their devotion to the highest ideals of science. Twenty years more of association with him personally and professionally made indelible these impressions of his critical guardianship of science.

But Professor Bayley was not only a teacher and a critic. He was a research investigator and writer of great merit. For many years he devoted his summers to intensive field work. Establishing an early connection with the U. S. Geological Survey as assistant geologist and later as geologist he did a great deal of work on the pre-Cambrian rocks and iron ores of the Lake Superior region in northeastern Minnesota and in northern Michigan. Many articles came from this work as it progressed, nine of them within six years, besides a continued series of five articles on the basic massive rocks of the Lake Superior region. Then came two extensive reports as junior author with Professor C. R. Van Hise on the Marquette iron-bearing district of Michigan in 1895 and 1897 and a monograph under his own authorship on the Menominee iron-bearing district of Michigan in 1904, besides more papers of increasing significance, including one on the water resources of Maine and two geologic atlases of areas in Michigan and New Jersey, which were in joint authorship with Van Hise and N. H. Darton, respectively. Seven other notable publications punctuated a total of forty-one scientific entries, ninety-seven book reviews and three text-books in his labor-won bibliography. The scope of his work embraced mineralogy, petrography, areal geology, underground waters, economic geology, metalliferous deposits, clays and the history of geology, which was in widely distributed areas—Maine, New York, New Jersey, Birmingham, North Carolina, Tennessee, Georgia, Texas, Minnesota, Michigan and Canada. He was connected at one time or another with the state geological surveys of New Jersey, North Carolina and Tennessee.

Some of his life's energies were also devoted to certain scientific journals, having been associate editor of *American Naturalist*, 1886–87, reviewer for Neues "Jahrbuch für Mineralogie," Berlin, 1890–1908; and business editor of the *Journal of Economic Geology*, 1905–42. He was honored by being made councilor of the Mineralogical Society of America, 1931–34, and its president in 1936; councilor of the Geological Society of America in 1919 and 1937, and a vice-president in 1936; councilor of the Society of Economic Geologists, 1925–27, and vice-president in 1932. He was also faithful in promoting interest in science in his state of adoption and was honored with the presidency of the Illinois Academy of Science in 1922–23, during which office he sponsored the organization of a Junior Academy of Science for high-school students. He was always solicitous in safeguarding the educational interests and standards of the University of Illinois and served on important and influential committees. In recognition of Professor Bayley's scientific attainments and of his devotion to his alma mater he was selected by the Johns Hopkins University as a representative of its scientific alumni on the occasion of the celebration in 1927 of its fiftieth anniversary.

Although his death on February 13, 1943, is a real loss to science, all of us who knew him well and the many who knew only his work must feel a deep sense of gratification and inspiration in a life so full, so exemplary and so richly productive.

M. M. LEIGHTON

ILLINOIS STATE GEOLOGICAL SURVEY

RECENT DEATHS

DR. C. STUART GAGER, for thirty-three years, since its establishment, director of the Brooklyn Botanic Garden, died on August 9 at the age of seventy years.

DR. CHARLES MACFIE CAMPBELL, professor of psychiatry at the Harvard Medical School, died on August 7 at the age of sixty-six years.

DR. ARTHUR MONRAD JOHNSON, associate professor of botany at the University of California, Los Angeles, died on July 16 at the age of sixty-five years.

THE REVEREND ARTHUR J. HOHMAN, professor of chemistry and head of the department at St. Peter's College, Jersey City, N. J., died on August 3. He was fifty-six years old.

JAMES MOFFITT, curator of the department of ornithology and mammalogy of the California Academy of Sciences since 1936, while on active duty as a Lieutenant in the U. S. Naval Reserve was killed in an airplane crash at Dutch Harbor, Alaska, on July 2.

ALBERT W. WHITNEY, formerly consulting director of the National Conservation Bureau of the accident prevention division of the Association of Casualty and Surety Executives, from 1904 to 1913 assistant and associate professor of mathematics and insurance at the University of California at Berkeley, died on July 27. He was seventy-three years old.

JOHN WATSON ALFORD, consulting engineer of Chicago, died on July 31 at the age of eighty-two years.

ROBERT SPURR WESTON, of Rhode Island, consulting sanitary engineer, died on July 29 at the age of seventy-four years.

DR. ARTHUR NEIVA, head of the Division of Entomology at the Oswaldo Cruz Institute, died in Rio de Janeiro on June 6 at the age of sixty-three years.

SCIENTIFIC EVENTS

INDUSTRIAL RESEARCH IN GREAT BRITAIN

SIR EDWARD APPLETON, secretary of the British Department of Scientific and Industrial Research, in opening the new physico-chemical laboratories of the British Coal Utilization Research Association at Coombe Springs on June 23, is reported in *Nature* to have congratulated the association both on its new facilities in laboratory space and on the financial provision now available for large-scale work. Sir Edward said that the steps the association has taken are among the first notable signs of a great forward movement in industrial research in Great Britain, which he confidently expects will be one of the features of post-war Britain. The Coal Utilization Research Association is serving the coal industry as a whole, and he particularly welcomed the expression of the interest of the miners themselves, shown in the recent appointment of two members of the Mineworkers' Federation to the council of the association. It is, he said, fashionable nowadays to decry British industrial research effort, because it is claimed that the amount of money spent on research per head of population is less than that in certain other countries. Much depends, of course, on what basis such a calculation is founded; whether or not, for example, development costs are included under the heading of research. Moreover, there can be unwise expenditure, as well as wise expenditure, even on research. But it can certainly be stated that British effort on research is not commensurate with our industrial needs. To talk merely of spending more money, however, was not enough. It was necessary to plan our attack on both new and old problems and, most important of all, to attract some of our best scientific brains in the country to solve them.

It has also been stated that, whereas Great Britain has, in the past, been responsible for many of the most fundamental discoveries in science, other countries have often been the first to apply them to practical ends. Sir Edward said that he could safely predict that when the full story can be told after the war, work in the application of science, as distinct from the accumulation of scientific facts, will be found second to none. He instanced the example of one of the most striking of our war-time developments, namely, that of radio-location, which was not, as is commonly supposed, a new invention. Here a technique developed for purely scientific ends has been magnificently applied by young British scientific workers to practical wartime uses. In this and other fields it has been amply demonstrated that the young men of Great Britain can hold their own in bridging the gap between laboratory science and its useful expression in appliances and industrial processes.

THE WARTIME CONFERENCE OF THE AMERICAN PUBLIC HEALTH ASSOCIATION

The Wartime Conference and the seventy-second annual business meeting of the American Public Health Association will be held in New York City from October 12 to 14. The Hotel Pennsylvania will be headquarters. Health workers within easy access of New York City are invited to attend. Representation of distant areas will be provided by appointed delegates.

The local committee in charge of arrangements of which Dr. Ernest L. Stebbins, Health Commissioner of New York City, is chairman, includes: *Honorary Chairman,* The Honorable Fiorello H. LaGuardia; *Co-chairman,* Edward S. Godfrey, Jr., M.D.; *Secretary,* Leona Baumgartner, M.D.; *Treasurer,* Matthew Byrne.

The following have agreed to serve as chairmen of the sub-committees: *Finance,* Frank Kiernan; *Meeting rooms,* John Oberwager, M.D.; *Publicity,* Frank A. Calderone, M.D.; *Radio,* Iago Galdston, M.D.; *Reception,* John L. Rice, M.D.

Half-day special sessions will be held on the following subjects: Current health department problems in war; tropical and imported diseases; new ventures toward health security and postwar planning.

The tentative section programs list such topics as: The war physical fitness program, plasma reserves for civilian defense, conquest of industrial noise, syphilis and gonorrhea, meningitis, health of the army, diarrheal diseases, international vital statistics, aviation medicine, tuberculosis, the health education program in wartime, chemical warfare and the laboratory, tropical diseases and the laboratory, report of the commission on vital records, community emergency service and war industry, wartime problems of the county health officer, nutritive value of preserved foods, nutrition policy here and abroad, health standards for day care centers, wartime adjustments of school health personnel. There will be a "Convention by Radio" during which the resolutions, the transactions and as much as possible of the program of the Wartime Conference will be broadcast to members at home.

The September issue of *The American Journal of Public Health* will print the program. Further information may be obtained from the American Public Health Association, 1790 Broadway, New York 19, N. Y.

APPEAL OF THE WAR POLICY COMMITTEE OF THE AMERICAN INSTITUTE OF PHYSICS

The War Policy Committee of the American Institute of Physics has outlined a program of post-war development for physics. Part of this program is a proposal to purchase a building to serve as an operating office for the institute, as a New York center available for the use of the Founder Societies, and as headquarters for the physicists of America. This proposal was approved and adopted by the governing board on July 24 and the committee was appointed to conduct a campaign to raise the necessary $75,000.

The society has grown from a hundred members in 1900 to over 6,000 members at the present time. Its immediate objects are given as follows:

(*a*) Improve meetings and strengthen journals.

(*b*) Cement the unity of the physics profession.

(*c*) Retain the loyalty of specialist groups and keep them identified with physics.

(*d*) Improve the teaching of physics at the high-school level.

(*e*) Expand, re-examine and improve physics training at the college and post-graduate level.

(*f*) Adopt suitable standards of professional competence and accredit training institutions.

(*g*) Bring increasing resources and facilities to the support of education and research in physics.

(*h*) Promote the employment of physicists in industry.

(*i*) Aid in the rehabilitation of war-interrupted careers of physicists and students of physics.

(*j*) Conduct an appropriate campaign on behalf of public appreciation of physics as a constructive peacetime activity.

(*k*) Inaugurate traveling lectureships, awards recognizing achievements, bulletins and other miscellaneous services as may be found desirable.

(*l*) Represent the profession of physics in informing and assisting legislators, and government executives considering laws and regulations affecting education, research and other activities of concern to physicists.

In making its appeal for funds the committee points out that it is an essential part of the proposal that there be acquired a permanent home for organized physics. The joint publishing and general cooperative operating department—the American Institute of Physics—has shown in its twelve years a consistent record of usefulness, reliability and increasing financial strength. It has always occupied rented office space. By virtue of the fact that it is a tax-free organization it could—if it had its own building—occupy and fully maintain much better and larger quarters at no increase in annual cost over the present rent.

It happens that at the present moment an extremely well-constructed and suitably arranged building has been offered for sale to the institute. It is conveniently situated on 55th Street between Madison and Park Avenues, New York, a neighborhood of excellent and improving value. If advantage is to be taken of this offer the sum of $75,000 must be guaranteed as soon as possible.

The appeal is signed by the War Policy Committee, the members of which are P. E. Klopsteg, *chairman*, O. E. Buckley, K. T. Compton, H. L. Dodge and R. C. Gibbs.

THE OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT

THE *Harvard Alumni Bulletin* gives the following particulars in regard to the Office of Scientific Research and Development:

> Once a year, a subcommittee of the Committee on Appropriations of the House of Representatives meets in Washington to consider requests for the following year for funds for the continuation of the National War Agencies. This is almost the only occasion when information of the work of the Office of Scientific Research and Development, which employs and uses so many Harvard scientists and laboratories and to which President Conant devotes so large a part of his time, enters the public record.
>
> In the hearing on the 1944 bill, held on May 29, Vannevar Bush, doctor of engineering, 1916, director of the office, and President Conant were two of the key witnesses. In support of an appropriation of $125,000,000 for the National Defense Research Committee, the two men revealed that approximately $2,000,000,000 worth of equipment had either been secured or was on order by the armed services through the work carried on by the office as the result of previous expenditures. More than 200 devices, Dr. Bush said, had been officially adopted out of the research of the office, and many of these had already seen service at the battlefronts.
>
> The scope of the work is indicated by the fact that from June, 1940, through April 17, 1943, a total of 1,731 contracts had been let among 124 different academic institutions and 205 different industrial organizations. The largest volume of work falls under the supervision of the National Defense Research Committee, of which President Conant is chairman.
>
> Appropriations requested for the Medical Research Committee, of which Dr. A. N. Richards, of the University of Pennsylvania, is chairman, and Professor A. Baird Hastings, Hamilton Kuhn professor of biological chemistry at the Harvard Medical School, is a member, amounted to somewhat less than $10,000,000. Concerning the work of that committee, Dr. Richards was enabled to reveal some remarkable developments made under its auspices in the use of penicillin, the new bacteria-destroying product made from green mold, which is expected to rival the miraculous sulfa drugs. He reported use of the drug in badly wounded cases in the Pacific area, which had been under treatment without success for as long as fourteen months. Persistent infections showed remarkable improvement within a week. Many units of the drug are now under manufacture, and have been sent to British and American forces in the field. Concerning details of the work of Mr. Conant's committee on instrumentalities of the war, no corner of the veil of military secrecy was lifted.
>
> Letters were read into the record by General Marshall, chief of staff of the Army, and by Admiral King, of the Navy, endorsing in wholehearted terms the services in the war effort of these civilian scientific groups working in cooperation with the Army and Navy.

MANPOWER PROBLEMS IN THE CHEMICAL INDUSTRY

A SYMPOSIUM on "Manpower Problems in the Chemical Industry" will be held in connection with the one hundred and sixth meeting of the American Chemical Society, which will take place at Pittsburgh from September 6 to 10. Dr. A. L. Elder, chief chemical adviser of the War Production Board, will preside.

Dr. Francis J. Curtis, development director of the Monsanto Chemical Company, will deliver an address on "How Industry is Solving its Manpower Problems"; James W. Raynolds, deputy director of the chemicals division of the War Production Board, will discuss "Production Requirements of the Chemical Industry"; Dr. Herman T. Briscoe, vice-president of Indiana University, will speak on "Training Programs for Chemists." Other speakers and their topics are: Dr. Warren L. McCabe, of the Carnegie Institute of Technology, "Training Programs for Chemical Engineers"; Dr. James Coull, of the University of Pittsburgh, "Training and Utilization of Women in the Chemical Industry"; Dr. Frank C. Whitmore, of the Pennsylvania State College, "Occupational Deferment of Technically Trained Men in the Chemical Industry"; Sidney L. Kirkpatrick, editor of *Chemical and Metallurgical Engineering*, "Manpower for Postwar Developments in the Chemical Industry."

Dr. Elder has pointed out that

> The expansion program of the chemical industry is fairly well adjusted to the needs of the armed services. When the plants now under construction are completed, it is anticipated that only minor further expansion will be required to keep the program in balance. On this basis one might at first assume that our worries should be nearly over. Actually, for several months it has been becoming more and more apparent that our troubles were only beginning, for production was not equivalent to plant expansion. The reason for this was obvious to all, but the solution is yet to be found. Manpower problems are confronting one industry after another.

Other symposia scheduled for the Pittsburgh meeting, in which 4,000 scientific men and industrialists are expected to participate, will deal with industrial hygiene, research tools of the colloid chemist, research management in small laboratories, unit processes, paint and plastics, reactions of solids, molecular addition compounds, library research, recent advances in the chemistry of dairy products, vitamins, proteins and boron in agriculture.

SCIENTIFIC NOTES AND NEWS

THE Alvarenga Prize of the College of Physicians of Philadelphia has been awarded to Dr. Ernest C. Faust, professor of parasitology and acting dean of the School of Medicine of Tulane University of Louisiana, in recognition of his "outstanding contribution to our knowledge of parasitology and tropical medicine."

THE *Journal* of the American Medical Association reports that the Medal of the Aztec Eagle for services and work on military medicine was recently presented to Drs. Edgar Erskine Hume and Tomás Cajigas, Washington, D. C., honorary members of the Academia Nacional de Medicina of Mexico. Dr. Francisco Castilla Nájera, the ambassador of Mexico to the United States, made the presentation.

SCIENCE has reported the names of those American scientific men who have been elected honorary fellows of the Royal Society of Edinburgh. British fellows were elected as follows: The Right Hon. J. C. Smuts, Prime Minister, South Africa; Professor H. F. Baker, emeritus professor of geometry and astronomy of the University of Cambridge; Sir Joseph Barcroft, emeritus professor of physiology of the University of Cambridge; Sir Lawrence Bragg, Cavendish professor of experimental physics at the University of Cambridge. Other elections to honorary fellowships include Dr. D. Emilio Jimeno Gil, rector of the University of Barcelona; Professor Thore G. Halle, Naturhistoriska Riksmuseum, Stockholm, and Dr. P. Karrer, professor of chemistry and director of the Chemical Institute, Zurich.

WASHBURN UNIVERSITY, Topeka, Kansas, on May 24 conferred the honorary degree of doctor of laws on Dr. F. D. Farrell, retiring president of Kansas State College, formerly agronomist of the Bureau of Plant Industry, and the honorary degree of doctor of science on Dr. George P. Grimsley, geological engineer, retired, of the Baltimore and Ohio Railroad.

THE degree of doctor of laws has been conferred by St. Olaf College, Northfield, Minn., on Dr. Donald C. Balfour, director of the Mayo Foundation for Medical Education and Research, Rochester, and the degree of doctor of science on Dr. Adolph M. Hanson, Faribault, in recognition of work on the isolation of the active principles of various hormones.

DR. CLEMENT C. WILLIAMS, president of Lehigh University, has presented his resignation to take effect in 1944. Dr. Williams became president of Lehigh University in 1935, after having been on the faculties of civil and railroad engineering at the Universities of Colorado and Kansas, head of the civil engineering department of the University of Illinois and dean of the College of Engineering at the State University of Iowa.

DR. EDWARD C. ELLIOTT, president of Purdue University, has resumed his work after a leave of absence that began in June, 1942. Since then he has served as chief of the division of professional and technical training of the War Manpower Commission, and was instrumental in setting up the war-training programs for the Army and Navy in American colleges and universities.

THE retirement from active work with the title emeritus at the end of the summer quarter has been announced by the Ohio State University of Professors Harry W. Kuhn and Samuel E. Rasor, both of the department of mathematics; of Professor Andrews Rogers, of the department of obstetrics, and of Professor Clifford C. Huntington, of the department of geography.

WILLIAM PETERSON, director of the Utah Agricultural Experiment Station from 1921 to 1928 and director of the Extension Service from 1924, retired with the title emeritus on June 30. He will serve as adviser on agricultural problems. W. W. Owens, assistant director of the Extension Service since 1920, was appointed to succeed him.

PROFESSORS BYRON E. COHN and Essie White Cohn have returned to the University of Denver from Washington. Dr. Byron Cohn has been in the research department of the Naval Ordnance Laboratory and will return as professor of physics. Dr. Essie White Cohn has been a visiting professor in biochemistry in the School of Medicine of George Washington University. She will return to her position as associate professor of chemistry. They will both serve in the instruction of the basic engineering unit of the Army Specialized Training Program.

DR. JAMES B. LOOPER, professor of anatomy at the University of Mississippi, has been appointed assistant dean of the School of Medicine.

DR. KIRK BRYAN, associate professor of physiography, and Dr. Derwent Whittlesey, associate professor of geography, at Harvard University, have been appointed, respectively, professor of physiography and professor of geography, as of July 1.

AT the University of Cincinnati, Dr. Charles K. Weichert has been promoted to a professorship in zoology and Dr. Francis E. Ray to an associate professorship in chemistry.

DR. LOUIS S. GOODMAN, assistant professor of pharmacology of the Yale University School of Medicine, has been appointed professor of pharmacology and physiology and chairman of the department of the College of Medicine of the University of Vermont.

DR. HENRY J. BARRE, of the department of agricultural engineering of Iowa State College, has been appointed head of the department of agricultural engineering of Purdue University. Dr. Barre will have under his charge teaching, extension and research.

DR. RUDOLPH G. MINARIK, of the Kimberly Clark Corporation, Neenah, Wis., has been appointed professor of mechanical engineering at Syracuse University.

DR. C. S. MAURICE, formerly of the department of geology of the University of Tennessee, more recently associated with Dartmouth College, has joined the faculty of William and Mary College, Williamsburg, Va.

DR. CHARLES H. DANFORTH, professor of anatomy at the School of Medicine of Stanford University, San Francisco, has been appointed honorary librarian of the California Academy of Sciences.

WALTER J. MURPHY, editor of *Industrial and Engineering Chemistry* and *Chemical and Engineering News*, publications of the American Chemical Society, has been appointed a member of the National Research Council, Division of Chemistry and Chemical Technology, for a period of three years.

DR. ERWIN E. NELSON, since 1937 professor and head of the department of pharmacology of the School of Medicine of Tulane University, has been appointed director of research in the experimental research laboratories of the Burroughs Wellcome and Company at Tuckahoe, N. Y.

DR. EDWARD D. DAVY, dean of the School of Pharmacy of Western Reserve University, has been appointed director of the pharmaceutical division of the Winthrop Chemical Company, with headquarters in Rensselaer, N. Y.

THE British Medical Research Council has organized a Penicillin Clinical Trials Committee. Its members are Professor H. R. Dean (chairman), Dr. A. N. Drury, Professor A. Fleming, Professor H. W. Florey, Dr. Percival Hartley, R. Vaughan Hudson, Dr. C. M. Scott, Dr. J. W. Trevan, Professor R. V. Christie (secretary) and Professor L. P. Garrod (assistant secretary).

IT is announced in the daily press that Sir John Anderson, Lord President of the Council and member of the British War Cabinet, has arrived in Washington. Sir John is the head of the central government organizations responsible for scientific research in the United Kingdom—the Department of Scientific and Industrial Research, the Medical Research Council and the Agricultural Research Council. He is also president of the Scientific Advisory Committee of the War Cabinet.

PROFESSOR SEMON SARKISOV, vice-president of the Scientific Medical Council of the U.S.S.R., and director of the Institute of the Brain, Moscow, spoke on July 15 on Soviet medical workers in the present war before the Royal Society of Medicine, London.

THE resolutions adopted by the council of the American Association for the Advancement of Science on the Science Mobilization Bill were printed in the issue of SCIENCE for August 6. The vote of members of the council, as reported in the *A. A. A. S. Bulletin* for August, was: Approval, one hundred and forty-six; opposed, five.

THE National Technical Meeting of the American Institute of Electrical Engineers will be held at Salt Lake City from September 2 to 4.

IN collaboration with the British Red Cross Society, according to *Nature*, arrangements have been made by the Institution of Electrical Engineers for British prisoners of war in Germany to sit for the associate membership examinations held in May and November, 1942. There were nineteen such candidates who took the examination, or parts thereof, on one or other of the two dates, seven of whom were successful in passing Parts I and II, three in passing Part I only and one Part II only. Five others passed in single subjects, a special concession having been granted to prisoners of war to take one subject at a time if they so desired. A commendably high standard of marks was reached by the candidates. Seventeen candidates in Germany entered for the May, 1943, examination.

A REUTER dispatch from Chungking states that in his will, made in 1939, the late President of China, Lin Sen, bequeathed $500,000 (Chinese) for the promotion of scientific education for the specific purpose of sending Chinese students abroad to pursue advanced studies.

Nature reports that though the building of the Wellcome Research Institution suffered considerable damage by enemy action, its structure was unharmed and the two Wellcome museums can quickly be put into shape as soon as labor and materials become available after the war. While some of the objects in the Wellcome Historical Medical Museum were damaged, it has been possible to replace or repair most of them. The specimens and other valuable material in the Wellcome Museum of Medical Science remained comparatively intact. Both museums are now under the directorship of Dr. S. H. Daukes. A comprehensive scheme for the Wellcome Historical Medical Museum has been prepared and will be brought to completion as speedily as possible after the cessation of hostilities. The Wellcome Medical Library, comprising more than 150,000 volumes, will also be in the same building, and suitable accommodation will be provided for research workers so that both the library and collections may be readily available. The Wellcome Museum of Medical Science—which in the past has been much used by teachers, students and those engaged in post-graduate studies—will be reestablished in its entirety. The large lecture hall will be fully re-equipped, including film projection apparatus, and will then be available for scientific lectures and meetings.

DISCUSSION

THE SCIENCE MOBILIZATION BILL

SCIENCE is to be commended most highly for devoting some of its columns to the free discussion of the Science Mobilization Bill, S. 702. This legislation is of great importance to all scientific and technical people, and, finally, to all people of the nation. Full discussion will ultimately bring out the real issues related to this bill.

More than a thousand letters have come to me about S. 702. From these letters I find that the men of science favor the bill. The vested interests, and those who are influenced or controlled by the vested interests, are against it, and they are most unscientific in their attacks upon it.

In reading the series of letters that has appeared in SCIENCE, I am impressed with the fact that most of these letters are concerned with peripheral, irrelevant or misleading material. To illustrate, let me cite a part of the communication from Dr. Gustav Egloff, of the Universal Oil Products Company, in the issue for June 18. To support his contention against Professor L. C. Dunn that "95 per cent. of our scientific and technical manpower and facilities are now highly organized and coordinated to the single end of advancing the war effort," Dr. Egloff quotes percentages from William L. Laurence's article in *The New York Times* of January 3, 1943, but he carefully refrains from quoting the preceding sentence giving actual figures. This is the unquoted sentence: "A survey now being carried out by our research personnel reveals that between 80,000 and 100,000 scientists are working, with about 80,000 in industrial and 20,000 in university laboratories."

In the same letter, Dr. Egloff lists 231,571 scientific and technical personnel, exclusive of medical and dental personnel, registered with the National Roster of Scientific and Specialized Personnel. Dr. Leonard Carmichael, director of the roster, testifying before the Science Mobilization Committee last October, said that the number of scientists and technical men might be tripled with complete coverage, indicating that only about one third of the available people were then listed on the roster. Multiplying Dr. Egloff's figure by three, the total would be in the neighborhood of 695,000. If, then, Dr. Egloff's 95 per cent. of 100,000 people, or 95,000, are at war work, the total so engaged is only about 13½ per cent. This calculation is, of course, as ludicrous on the one side as Dr. Egloff's on the other. I give it only to show how figures can be used to mislead. Scientific and technical people who actually do the work know from their own experience and that of their associates the extent to which their talents are being used to prosecute the war.

Dr. Egloff, of the Universal Oil Products Company, also uses other interesting techniques in his fight against this legislation. I quote him:

> It is not too much to say that their passage [the two mobilization bills] might well be worth 100 divisions to our enemies.—*The Chemist*, April, 1943, page 229; *The Journal of Commerce*, April 12, 1943; *The Chicago Trib-*

une, March 14, 1943; the *Washington Times-Herald*, March 14, 1943.

Their passage would be worth 100 divisions to the enemy.—*The Chemist*, April, 1943, page 252.

The bill would be worth 100 divisions of trained, motorized troops to Adolph Hitler. *Chicago Tribune*, June 17, 1943.

Adolf Hitler wrote in "Mein Kampf":

> . . . in the big lie there is always a certain force of credibility.

And:

> . . . only constant repetition will finally succeed in imprinting an idea on the memory of the crowd.

So here we have Dr. Egloff, of the Universal Oil Products Company, using two of Hitler's techniques in his effort to defeat this bill. Also, it is significant to note that the *Chicago Tribune* and *Washington Times-Herald* gave strong play to his words.

I am deeply concerned that American men of science participate in a full discussion of this legislation: They alone can provide the advice and counsel to make the bill adequate to the national need.

The bill is based on five primary needs:

1. The need for a central independent agency of government devoted exclusively to the progress and expansion of science and technology, first to win the war and later to contribute to the peace. Science and technology need to be considered as a national resource, serving the interests of the nation as a whole and not those of select groups. Indeed, it is the only remaining sector of our public domain. This agency should be an independent arm of Government, eventually on the same footing as the established departments.

2. The need for integration of existing government research and development facilities. There are about 20 major and 40 minor bureaus in the Government devoted to research and development; their operation cost more than $557,000,000 last year. The excellent work of these groups should be so integrated as to widen the usefulness of their work and to provide a greater service to the public.

3. The need for active governmental support of fundamental research. The Government should give widespread support to basic research, by grants to existing non-governmental as well as governmental groups. This would apply particularly to universities and colleges, where fundamental research should flourish. Insufficient budgets have caused our educational institutions to depend increasingly on industrial grants and fellowships. This, to an alarming degree, has reduced much of university research to the status of handmaiden for corporate or industrial research, and has resulted in corporate control of many of our schools.

4. The need for a uniform and effective policy to achieve the fullest utilization of scientific and technical manpower in wartime.

5. The need to promote the use of government patents in the interest of the public. These patents are to be clearly distinguished from privately owned patents. They are of three types: Those derived from government research and development and assigned to a Federal Department or Bureau; those held by the Alien Property Custodian; those derived from non-governmental research financed by Federal funds.

The use of these patents needs to be promoted, and they should be administered for the public good.

I have long realized the basic importance to the welfare of the country of a free science and an expanding technology. I have long advocated a far-reaching program of governmental research. The experience of Federal agricultural research provides ample precedent for such a step. I have also observed that all advances in the public interest are fought bitterly by selfish interests. Examples have been the establishment of our public school system, public ownership of municipal water supplies, enforcement of sanitation of the milk supply, range and forest conservation, public ownership of power, and so on.

Scientific and technical men hold in their heads and hands the collective knowledge of the ages. Whose knowledge is it? This group, more than any other, can help achieve these purposes: To free technology for its maximum use in this technological war, and to free technology for the greater advancement of the American people.

HARLEY M. KILGORE

U. S. SENATE

SALMON CONSERVATION

I WISH to call attention to an article in "Discussion" in the March 12, 1943, issue of SCIENCE, entitled "The Fundamentals of Salmon Conservation."

The article in question has absolutely *nothing* to do with salmon conservation. The author, however, has taken advantage of the current food shortage to try to show some practical use for a pet experiment.

Just what difference could it possibly make to salmon conservation if ". . . the salmon with lateral line nerves bilaterally sectioned should be less apt to find their home stream than those with their lateral line nerves intact."

If the author merely wishes to discover what factor guides salmon in their return to their parent stream we have no quarrel with him. We do wish to point out, however, that his project should not masquerade either as a war-time food problem or even as a project fundamental to salmon conservation.

GEORGE A. ROUNSEFELL

U. S. FISH AND WILDLIFE SERVICE,
CAMBRIDGE, MASS.

TRANSLITERATION ONCE MORE

DR. DUNLAP makes an important point[1] when he calls attention to one source of confusion in the transliteration of words from languages not written in the Latin alphabet. The bad habit in question consists in taking over transliterations bodily from such languages as French or German even when these transliterations are no longer appropriate in English. For example, one might thus take over the French transliteration of the Arabic word for mountain, namely, *Djebel.* As Dr. Dunlap remarks, "Of course the *D* is essential in French but redundant in English, since the English *J* has the sound which can be written in French only by *Dj.*"

It is important to call attention, however, to one important exception to the rule that foreign transliterations should not be taken over into English. It is a principle adopted by the United States Geographic Board that when the Latin alphabet is "habitually or alternatively" used in a "country, dominion, colony, protectorate, or possession" local official usage should be followed except where there is a different conventional English form. Even in the latter case the better practise is to follow the local form. This makes for simplicity in international usage. It is confusing when Polish speakers write *Waszyngton* for *Washington* and on the same principle it is better for us to write *Djibouti* (French Somaliland) rather than *Jibuti,* although this involves precisely the peculiarity of transliteration to which Dr. Dunlap objects.

Again, Dr. Dunlap errs when he implies that a transliteration such as the Chinese *Tao* is due to slipshod borrowing from a system of transliteration conventional in some other language. *Tao* is a spelling which follows the standard Wade system of transliteration—or Romanization as it is generally called in this connection. Sir Thomas Francis Wade (1818–1895) was a British diplomat who spent many years in China and was afterwards professor of Chinese at Cambridge. His system of Romanization is followed by the vast majority of American and English Sinologists, and attempts to alter it are looked on with disfavor. There is good reason for this; for *Tao* is not "sounded *Dow*" as Dr. Dunlap says. The initial consonant is a devoiced *d,* therefore approximately half way between our English *d* and *t* except that it is unaspirated. The diphthong actually glides from a variety of *a*-sound to a variety of *o*-sound. To write *Dow* instead of *Tao* would not be an unquestionable improvement.

The moral of all this is simple. For every language written with a non-Roman alphabet there exists a system of transliteration which is accepted as more or less standard by specialists in the field, such as the Wade system for Chinese or the Hepburn system for Japanese. In addition, geographical names have special principles governing their use. The careful writer will take the trouble to familiarize himself with these systems or else consult experts to learn the correct usage in a particular case. A respect for scientific accuracy demands this if confusion is to be avoided.

PAUL HANLY FURFEY

THE CATHOLIC UNIVERSITY OF AMERICA

---

[1] SCIENCE, 97: 400–1, April 30, 1943.

SUGGESTED CHANGE IN DESIGNATION OF "RENIN-ACTIVATOR" (HYPERTENSINOGEN) TO RENIN-SUBSTRATE (α_2 GLOBULIN)

LELOIR, Muñoz, Taquini, Braun-Menendez and Fasciolo[1] have suggested that the term "renin-activator" should be dropped. In discarding it, we believe that the considerations which have influenced our using and retaining the word should be presented as well as those which now prompt us to propose a new term for the same entity.

When Kohlstaedt, Helmer and Page[2] found that renin was not a vasoconstrictor (or pressor) substance except in the presence of another protein present in blood, they identified this other protein as "renin-activator" for the simple reason that in its absence renin was not active. Without any further implication, this observation led to discovery of the pressor substance called "angiotonin" by the North American investigators, Page and Helmer,[3] and "hypertensine" by the workers of South America, Braun-Menendez, Fasciolo, Leloir and Muñoz.[4] In the course of studies on the formation of angiotonin (hypertensine) from the mixture of renin and "renin-activator," evidence was obtained both in this country[5] and in South America[6] which indicated that the interaction was enzymatic and that the so-called "activator" was in fact the substrate. The Argentine group then proposed the use of the terms "hypertensinogen" or "hypertensine precursor" for the substance until that time known as "renin-activator." These terms they developed from the fact that the substance in question gives rise to the pressor substance "hypertensine." However, as has been pointed out editorially in the

---

[1] L. F. Leloir, J. M. Muñoz, A. C. Taquini, E. Braun-Menendez and F. S. Fasciolo, *Rev. Argent. Cardiol.*, 9: 269, 1942.

[2] K. G. Kohlstaedt, O. M. Helmer and I. H. Page, *Proc. Soc. Exp. Biol. Med.*, 39: 214, 1938.

[3] I. H. Page and O. M. Helmer, *Proc. Cent. Soc. Clin. Res.*, 12: 17, 1939.

[4] E. Braun-Menendez, J. C. Fasciolo, L. F. Leloir and J. M. Muñoz, *Rev. Soc. Argent. Biol.*, 15, 420, 1939.

[5] I. H. Page and O. M. Helmer, *Jour. Exp. Med.*, 71: 29, 1940.

[6] E. Braun-Menendez, L. F. Leloir, J. M. Muñoz and J. C. Fasciolo, *Rev. Asoc. bioquim, Argent.*, 5: 17, 1940.

Journal of the American Medical Association,[7] the term "hypertensine" does not follow North American practice in that its selection evidently is intended to imply its causal relationship to hypertension, a relationship which has not been completely established. Further, the term "urohypertensine" has been used to denote a pressor substance in urine which in all probability had nothing to do with hypertension.

Meanwhile, we had retained the non-committal term "renin-activator" and used it without particular reference to its enzymatic rôle, since it was desired to avoid solidifying concepts and terminology in advance of full and complete evidence of the nature and function of this substance. Plentl and Page[8] have now by kinetic analysis established beyond a doubt the enzymatic nature of the interaction of renin with a protein substrate, the so-called "renin-activator," and Plentl, Page and Davis[9] have gone on to show that this substance is identical with or moves with the same electrophoretic mobility as α_2-globulin. Even with this background of evidence, the otherwise attractive term "hypertensinogen" should not be adopted since, as noted above, the term "hypertensine" is unsatisfactory. Further, the suffix "-ogen" in enzyme chemistry usually refers to a mother substance which, by a molecular rearrangement, gives rise to another substance, *often itself an enzyme, e.g.,* pepsinogen, trypsinogen, etc.

Since it now seems desirable to discard the term "renin-activator" and since the evidence is at hand to substantiate the implications of the terminology, we suggest that the purely descriptive word "renin-substrate" be applied to this substance and that, when it is considered useful to indicate its presence in, or identity with, the protein fraction α_2-globulin, this be added as postscript and the term written "renin-substrate (α_2-globulin)."

I. H. PAGE
O. M. HELMER
A. A. PLENTL
K. G. KOHLSTAEDT
A. C. CORCORAN

SCIENTIFIC BOOKS

THREE MATHEMATICAL TEXT-BOOKS

Aircraft Mathematics. By S. A. WALLING and J. C. HILL. 189 pp. Cambridge: The University Press; New York: The Macmillan Company. 1942. $1.25.

Principles of College Algebra. By M. S. KNEBELMAN and T. Y. THOMAS. x + 380 pp. New York: Prentice-Hall, Inc. 1942. $2.50.

Differential Equations. By R. P. AGNEW. vii + 341 pp. New York: McGraw-Hill Book Company, Inc. 1942. $3.00.

THESE three books deal with essentially distinct domains of mathematical instruction, both as to the material included and the degree of mathematical knowledge presupposed. They have one important point in common, however. They aim at a genuine comprehension of the material covered rather than a mere training in the formal use of it. Having been written by highly competent teachers of mathematics, with a secure mastery of their subject, they are well adapted to the realization of this aim.

The first book covers material within the range of any properly trained first-year high-school student. In fact, since about a third of the book is devoted to arithmetic, some of the material should be review work for such a student. The other subjects treated may be classified as algebra, geometry and trigonometry, with numerical trigonometry and the use of logarithms in computation marking the upper limit of advancement. The book is frankly intended for the present emergency and selects such elements of mathematical theory and application as are essential for those entering on training for the Air Corps. However, the material is well integrated and arranged in order of logical development. The problems are well selected and pertinent to the aim of the book. Altogether, the authors have done an excellent job.

The second book is primarily suitable for a freshman or sophomore in college, though much of it would be valuable for a junior or senior student who had not previously received a good training in algebra. In view of the recent tendency to cut short the mathematical instruction in high school, and in college to get on as rapidly as possible to the elements of the calculus, there has been a neglect of the domain known generally as college algebra. On account of the importance of algebraic theory in many of the recent developments of theoretical physics, such a lacuna in mathematical training has become increasingly disadvantageous. The inclusion of a course dealing with the material of the book under review is thus seen as highly desirable in a proper scheme of mathematical education.

Professors Knebelman and Thomas have included all the classical topics of college algebra in their book and have given an unusually careful discussion of these. Other topics, not so generally treated, such as matrices and linear dependence, are also included. On the whole, the book is thoroughly modern and pedagogically excellent. It is a valuable addition to available books in the field.

---

[7] Editorial, *Jour. Am. Med. Asn.*, 120: 923–924, November 21, 1942.

[8] A. A. Plentl and I. H. Page, *Jour. Biol. Chem.*, 147: 135, 1943.

[9] A. A. Plentl, I. H. Page and W. W. Davis, *Jour. Biol. Chem.*, 147: 143, 1943.

The third book falls in a somewhat more advanced field, being suitable for a junior or senior in college or a first-year graduate student who has had no systematic training in differential equations. A special effort has been made by the author to avoid mere formalism and to see that the student gets at the heart of the matter. This effort will undoubtedly be amply justified in the way of increased understanding on the part of students who make use of the book. The fundamental notions and theorems of analysis that have special significance in discussing the solutions of differential equations, such as the Riemann definition of the integral, the varied behavior of functions as to continuity and existence of derivatives, the widening of a class of functions by considering indefinite integrals of such functions, are introduced early in the book and effectively used thereafter. The choice of problems is excellent, and many of them furnish a good introduction to important applications of the theory.

A valuable feature of the book is the excellent discussion of Picard's method of successive approximations, both as a method of solving equations and as a means for proving existence theorems. This discussion includes the treatment of equations of higher order and of systems of equations. It rounds out in excellent fashion the theoretical side of the work.

From every point of view Professor Agnew's book is a noteworthy addition to available texts for an introductory course in differential equations. Its appearance will be welcomed by those who have occasion to conduct such a course and by students who need to pursue the subject on their own initiative.

CHARLES N. MOORE

UNIVERSITY OF CINCINNATI

BIOCHEMISTRY AND MORPHOGENESIS

Biochemistry and Morphogenesis. By JOSEPH NEEDHAM. 785 pages. Cambridge: At The University Press. New York: The Macmillan Company. 1942.

ALTHOUGH this book is not a continuation of Dr. Needham's classical work in three volumes on "Chemical Embryology," published in 1931, it is a timely and worthy successor, still concerned with the relation between morphology and chemistry. There are many references back to the earlier work in lieu of repetition, and the present book includes within its treatment most of the advances in the field of chemical embryology that have occurred since 1931. It thus serves as a sequel to bring that subject up to date. It does more than this, however. The present book goes well beyond a descriptive account of the biochemistry of the developing embryo; it goes about as far as the present state of knowledge permits in attempting to analyze the causal aspects of morphogenesis by explaining the unknown in terms of the known or better known, including specific substances when possible. In effect, an integration of chemical embryology and experimental embryology is attempted, which means a meeting on common ground of biochemistry and morphology.

Since the beginning of the present century, and even earlier, it has been shown repeatedly by amputation, transplantation and other types of experiments on many kinds of embryos (and regenerating adults) that the developmental fate of a part of the egg or embryo may be profoundly affected by its physical proximity and relation to other parts. This dependence in differentiation has in many instances been taken to imply the existence of morphogenetic hormones. Morphogenetic hormones have indeed also been found in plants, in which they have in certain cases been more quickly and more readily identified than in animals. The influence of one part of an animal embryo on another is strikingly shown in the "inducing" or "organizer" action of the cells of the dorsal lip of the vertebrate blastopore, which impose the main primary pattern of differentiation of the embryo upon neighboring cells with which they come in contact. In 1931 Spemann demonstrated that destroying the living integrity of such cells by crushing had little or no effect upon their inducing activity, and Holtfreter and others soon found that the inducing activity survived boiling, which destroys enzymes. These far-reaching experiments banished the last remnants of any basis for the mysticism still occasionally associated with the inductor agencies and stimulated intensive attempts both to isolate inductor substances, in which Dr. Needham himself took the lead, and to further understand their action. Substances of known composition were found that possess inducing activity, although it is not yet certain whether they are the same agents that act naturally or whether they stimulate or release the natural agents.

The second and longest part of the book is devoted to a comprehensive and penetrating consideration of morphogenetic stimuli and their actions. There is clear recognition of the great rôle of the reacting systems that respond to the stimuli in ways not yet clearly understood. The account shows that great advances have been made and that many more are yet to be expected. It also reveals the great intricacy and complexity of the processes of development that have for so long intrigued, baffled and fascinated the mind of man.

In Part 1 the morphogenetic substratum is considered from the point of view of the chemical raw materials available for development. The lucid account of nutritional and other problems that eggs and embryos have solved in adapting to the limitations of their environment is a most interesting and valuable contribution to the study of evolution and natural history. Part 3 is devoted to the morphogenetic mechanisms, including the special metabolisms of embryonic life with its sequence of energy sources, etc., and also such general questions as dissociability, growth, polarity, etc. In considering growth, attention is focused on the relative proportions of constituent materials at different stages in the development of the individual and in widely different species.

The treatment is broad and inclusive throughout. While the book is primarily concerned with recent facts and concepts, these are constantly projected in perspective against historical and philosophical background. A spirit of optimistic mechanism pervades the treatment, and an old subject is admirably treated in the light of current knowledge under the picturesquely modern heading, "The Liquidation of the Entelechy." The concept of levels of organization is stressed, and finally a parallel is drawn between organic and social development.

Cancer and teratomatous tumors are considered in relation to the organizer phenomena. Striking chemical similarities and overlapping functions are noted among certain substances acting as sex hormones, carcinogens and primary organizers (evocators). Cancer appears to involve the problem of anomalous differentiation or lack of differentiation, and thus to be related to phenomena studied in experimental and chemical embryology. Students of cancer will wish to familiarize themselves with Dr. Needham's account and point of view.

The book is abundantly and well illustrated, and a convenient system of numbering the sections or subjects is employed. The quality of the paper, as in most recent books, is not up to pre-war standards. An interesting side-light on the creation of books in England under conditions of war was shown this winter at the Yale University Library when copies of the various steps in the preparation of this book, the manuscript, galley, page proof, microfilm of the corrected page proof, etc., were put on display. These copies had all been sent as they came into being to Dr. Ross G. Harrison as insurance against destruction of the originals.

Throughout, attention is called to probable future trends in research and to needed experiments yet undone. The bibliography is the most complete and extensive in existence since "Chemical Embryology" and includes references to recent reviews. This book represents a great accumulation of facts and a masterly synthesis of knowledge. It will be indispensable to the investigator and teacher alike.

DOUGLAS WHITAKER

SPECIAL ARTICLES

THIOURACIL IN THE TREATMENT OF THYROTOXICOSIS[1]

RECENT interest in the possible medical treatment of patients with thyrotoxicosis has been stimulated by the observations that certain sulfonamides, as well as thiourea[2, 3, 4] and its derivatives, induce a hypometabolic state when fed to rats for several weeks. The evidence that has been accumulated suggests that the lowering of the metabolic rate results from a decrease in the production of the thyroid hormone, which is presumably due to the action of these drugs on the thyroid gland. The latter becomes enlarged and hyperplastic, but its content of colloid is greatly depleted. The changes in the thyroid do not occur if the animal is fed desiccated thyroid or if a hypophysectomy is first performed. The above drugs do not interfere with the elevation of the metabolic rate induced by thyroxin or desiccated thyroid. The pituitary gland responds with the same type of hyperplasia as follows thyroidectomy.

Astwood[5] found that of a large group of sulfonamides and thiourea derivatives which he tested, thiouracil was the most effective in inhibiting the production of thyroid hormone. He used thiouracil in the treatment of three patients with thyrotoxicosis and in each case the metabolic rate returned to normal and the symptoms were relieved. However, when the drug was discontinued after one or two months, the manifestations of the disease reappeared. The course of one patient was complicated by the development of agranulocytosis.

During the last few months, we have used thiouracil[6] in the treatment of nine patients with thyrotoxicosis. This substance is a thiourea derivative with the following formula:

---

[1] From the Thorndike Memorial Laboratory, Second and Fourth Medical Services (Harvard), Boston City Hospital, and the Department of Medicine, Harvard Medical School, Boston.

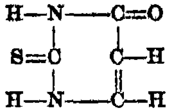
[2] Julia B. Mackenzie, C. G. Mackenzie and E. V. McCollum, SCIENCE, 94: 518, 1941.

[3] C. G. Mackenzie and J. B. Mackenzie, *Endocrinology*, 32: 185, 1943.

[4] E. B. Astwood, J. Sullivan, Adele Bissell and R. Tyslowitz, *Endocrinology*, 32: 210, 1943.

[5] E. B. Astwood, *Jour. Am. Med. Assn.*, 122: 78, 1943.

[6] Thiouracil was supplied through the courtesy of the Lederle Laboratories, Inc., Pearl River, N. Y.



It is a white crystalline powder which is readily soluble in sodium hydroxide, slightly soluble in water (1:2000) and insoluble in ether, ethyl alcohol and acids. It is a relatively stable compound, either as a solution or as a powder. It has no odor, but has a bitter taste.

Seven of the subjects were kept in the hospital for a few weeks and the other two were seen as out-patients at seven-day intervals. In most cases basal metabolic rates were determined about every seven days. A careful watch was maintained for any complications, the blood and urine being examined frequently. The unit dosage of thiouracil was 0.2 gram. During the first three weeks of treatment the total daily dosage was 1.0 or 1.2 grams spread out during the twenty-four hours; but during the second three-week period this was gradually reduced to about 0.2 or 0.4 gram daily. The daily excretion of thiouracil in the urine was followed in most cases and its concentration in the blood was determined.

All the patients had typical clinical manifestations of thyrotoxicosis. The duration of the illness ranged from six months to two years, except for one patient in whom it probably had existed for twenty-two years. In most cases, the thyroid gland was 2 or 3 times normal size. The early changes of malignant exophthalmos were observed in one patient. The initial basal metabolic rates ranged from plus 88 to plus 36 with an average of plus 63 (Fig. 1). In each case the clinical evidence of thyrotoxicity had disappeared and the basal metabolic rates had reached normal levels (average metabolic rate was plus 1) within from three to seven weeks following the initiation of treatment with thiouracil. The severe cases improved as rapidly, or even more rapidly, than the milder cases.

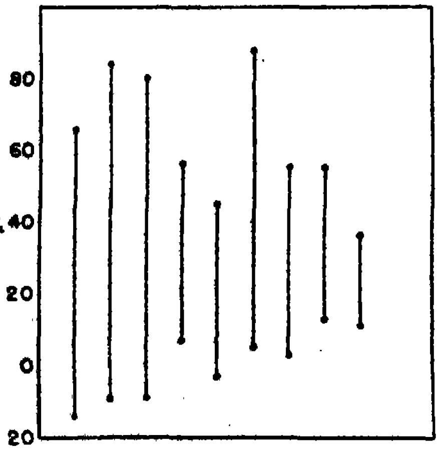


Fig. 1. Note the initial basal metabolic rates in each of nine patients and its response to treatment with thiouracil in each subject.

In the four patients in which studies of the protein-bound iodine of the plasma were conducted there was found a decrease to a normal or subnormal level within about four weeks after beginning treatment.

In three patients the thyroid gland became slightly larger during the first two weeks of treatment but subsequently decreased to about the pre-treatment size. In the other six patients the gland progressively decreased in size and returned to normal in two cases. The patient with the early changes of malignant exophthalmos experienced an increase in the oculopathy during the course of treatment with thiouracil. However, when desiccated thyroid was administered with the thiouracil the eyes showed definite improvement and the thyroid gland became smaller.

No serious complications were encountered in any case. Two patients developed slight transient swelling of the legs associated with a slight increase in the serum chloride and a decrease in the carbon dioxide combining power of the blood. No abnormalities in the serum proteins, non-protein nitrogen of the blood, phenolsulphonephthalein in the urine, nor in the routine urine examinations were found.

In 2 patients with untreated myxedema, we found that thiouracil did not inhibit the usual rise in the metabolic rate induced by the administration of 1.5 grains, daily, of desiccated thyroid. The foregoing observations indicate that thiouracil does not interfere with the effects of thyroxin when it is administered in a preformed state, but rather inhibits the formation of the thyroid hormone.

The optimum dosage of thiouracil has not yet been determined. In an effort to throw light on this point we have studied the rate of absorption of the drug from the gastro-intestinal tract, its distribution throughout the body and its rate of excretion. The method employed for the estimation of thiouracil is that of Williams, Kay and Jandorf.[7] The absorption of the drug from the gastro-intestinal tract was found to be very rapid. For example, following the ingestion of 0.2 gram of thiouracil the maximal blood level of the drug was obtained fifteen minutes later. When it is given in doses of 0.2 gram at four-hour intervals, about twenty-four hours are required to reach a constant blood level and a constant rate of excretion of the drug in the urine. When this dosage is maintained for several days, the blood level is maintained at about 3 mgms per 100 cc and about 300 mgms per day are excreted in the urine. Most of the drug in the blood is in the cells, the white cells containing a greater concentration, but a smaller total amount than the red cells. Studies are now being conducted to determine the optimum concentration of thiouracil in the thyroid and the time required to attain this level.

---

[7] R. H. Williams, G. A. Kay and B. J. Jandorf. To be published.

The present report is a preliminary one dealing with the early response of thyrotoxic patients to treatment with thiouracil. The assessment of the full value of this drug must await prolonged and extensive studies, including careful observations for signs of toxicity.

ROBERT H. WILLIAMS
GROSVENOR W. BISSELL

EFFECT OF VARIOUS CHEMICAL AGENTS AFFECTING PERMEABILITY OF THE MUCOSA ON THE FORMATION OF ULCERS

SCHIFFRIN[1] produced ulcers in the cat by running a 3 per cent. solution of pepsin in 0.1 N hydrochloric acid through a segment of the jejunum, but was unable to bring about ulceration when the acid alone was used. He emphasized the important role of pepsin in the formation of ulcers and was able to prevent the lesions by protecting the mucosa with colloidal aluminim hydroxide and aluminim phosphate.

The purpose of the investigation reported here was to study the influence of certain substances known to have marked effects in lowering surface tension or in otherwise increasing permeability of the mucosa to insulin, on the incidence and extent of the ulcerations initiated by pepsin and HCl. Chemically pure pepsin and insulin have similar molecular weights (unit weights by the ultra-centrifuge).

The method used in these studies was as follows. An incision was made in a dog under dial-urethane anesthesia, and the jejunum was brought to the surface of the abdomen. Three or 4 segments about 3 inches long, chosen in such a manner as to insure a good blood supply to each loop, were cannulated and reinserted into the abdomen, which was then closed. Solutions, preheated to 37° C., were allowed to flow by gravity through the loops at the rate of 3 cc per minute for 12 hours, or until a perforation occurred in one of the loops. The loops were then removed, split along the mesenteric line and examined grossly and microscopically. Thirty-two dogs were used. The particular loops used were not examined for spontaneous ulcers before perfusion, because to do so would require sacrifice of them before the experiment. However, in a large number of normal dogs used in this and other investigations[2] the spontaneous occurrence of a discrete ulcer has never been seen.

The concentrations of the substances used were: 0.1 N hydrochloric acid, 2 per cent. powdered U.S.P. Merck pepsin, 0.03 per cent. calgon (sodium hexametaphosphate), 0.1 per cent. hexylresorcinol, 0.05 per cent. pinacol (*tetramethyl glycol*), and 1 cc of methyl salicylate per liter of solution.

RESULTS

Table 1 gives the number of times a given solution was tried, the number of times ulcers were formed, and the percentage of this occurrence with the various solutions. Also included are the pH's of the solutions.

TABLE 1

OCCURRENCE OF ULCERS IN PERFUSED LOOPS

Solution	pH	Number of loops used	Number of times loops used appeared with ulcers	Percentage occurrence of ulcers
2 per cent. pepsin in distilled water	3.80	3	0	0
0.1N HCl	0.90	4	0	0
0.1N HCl and 0.1 per cent. hexylresorcinol.	1.05	3	0	0
0.1N HCl and 0.1 per cent. methyl salicylate	1.00	3	0	0
0.1N HCl and 0.03 per cent. calgon	1.15	6	1	16.6
0.1N HCl and 0.05 per cent. pinacol	1.00	3	1	33.3
0.1N HCl and 2 per cent. pepsin	1.10	22	6	27.3
0.1N HCl and 2 per cent. pepsin and 0.1 per cent. methyl salicylate	1.00	8	4	50.0
0.1N HCl and 2 per cent. pepsin and 0.1 per cent. hexylresorcinol.	1.10	13	7	53.0
0.1N HCl and 2 per cent. pepsin and 0.03 per cent. calgon	1.10	13	9	69.2
0.1N HCl and 2 per cent. pepsin and 0.05 per cent pinacol	1.10	7	5	71.4

In the loops through which pepsin alone was run the tissue appeared to be perfectly normal. When hydrochloric acid was run alone, the villi were sometimes partly destroyed. Hydrochloric acid with pepsin usually caused the villi to be destroyed with the frequent appearance of small ulcers. Hydrochloric acid with hexylresorcinol, calgon, pinacol or methyl salicylate usually produced some destruction of the villi. When calgon, pinacol, hexylresorcinol or methyl salicylate were introduced with both hydrochloric acid and pepsin, the submucosa was completely destroyed, usually showing black areas, as well as a high percentage of ulcers. On numerous occasions as many as 10 to 15 ulcers would appear in one loop when either of these compounds was used with HCl and pepsin. This was never the case when they were not used.

---

[1] M. J. Schiffrin, *Proc. Soc. Exp. Biol. and Med.*, 45: 592, 1940.

[2] R. L. Driver and J. R. Murlin, *Am. Jour. Phys.*, 132: 281, 1941.

Discussion

For a long time it has been a mystery to physiologists why digestive juices of the stomach ordinarily do not digest the tissue which goes to form the alimentary canal while ingested tissue is readily digested. Driver and Murlin[2] showed that certain substances can increase the penetrability of intestinal mucosa by a protein molecule, insulin, as judged by its effect on blood sugar. Of these compounds, all that have been tried, namely, calgon, hexylresorcinol, pinacol and methyl salicylate, brought about a tremendous increase in the number and severity of ulcers.

Calgon is a compound noted for its ability to tie up calcium ions.[3] Since this ion has been reported to inhibit absorption[4,5] and since calgon was found to promote the absorption of insulin,[2] it seemed reasonable to expect an increased penetrability by pepsin with a consequent incidence of ulcers when calcium was rendered non-ionic and therefore non-absorbable in the intestine. Calcium combines with lipids and proteins to produce a hardening and protective effect on the mucosa. It is not inconceivable that the beneficial effects of milk in the treatment of ulcers may be attributed in part to its calcium content, and it would seem that fortification of milk with a calcium salt is indicated.

Hexylresorcinol is a powerful surface tension lowering agent and produces structural changes in the membranes of the mucosa which modify permeability.[2,6] Methyl salicylate exerts a special irritating influence on mucous membranes which increases permeation of protein molecules. Pinacol has little irritating effect and does not lower surface tension appreciably. This compound probably changes the penetrability of the mucosa by proteins by its particular molecular configuration, the hydrophobic and hydrophilic groups acting as a lock and key mechanism. The formation of ulcers in these experiments was not due to a difference in pH of the solutions. We conclude that substances which increase the permeability of intestinal mucosa by a lowering of surface tension or other means facilitate the formation of ulcers.

R. L. Driver
G. S. Dozier
H. C. Denham
Department of Anatomy and Physiology,
University of Kentucky

---

[3] B. H. Gilmore, *Ind. and Eng. Chem.*, 29: 584, 1937.

[4] E. Gellhorn and A. Skupa, *Am. Jour. Phys.*, 106: 318, 1933.

[5] H. Drawert, *Ber. Deutsch. Bot. Ges.*, 55: 380, 1937.

[6] R. Höber, M. Andersh, J. Höber and B. Nebel, *Jour. Cell. Comp. Physiol.*, 13: 195, 1939.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

ON THE STAINING OF YEAST SPORES

Although it may be unnecessary to resort to staining procedures to demonstrate spores in some cultures of yeasts, frequently such stains are desirable for proof of the presence of spores or the proper delineation of these. As no one method of staining is used universally, each investigator uses the method of his choice, and this often is one of the methods used for bacterial spores. Thus, Henrici,[1] in a comprehensive review of the cytology and taxonomy of the yeasts, recommends the familiar technique of Moeller. This consists of primary staining with steaming carbol fuchsin, and, after proper destaining, counterstaining with Loeffler's methylene blue.

The above method, as used by the author, often gives slides with considerable precipitate, and frequently color differentiation between spore and vegetative cell is not clear. It seemed possible that the malachite green technique of Schaeffer and Fulton[2] might be more satisfactory since one step, the destaining procedure, is unnecessary. In this technique washing with water is sufficient to remove the primary stain from the vegetative cell. Only a few trials were needed to verify this assumption. Exceptionally clear differentiation was the usual result. Review of the literature revealed that Shimwell[3] had tried the technique with yeasts, although he modified the procedure by using alcohol as a destaining agent. Our results have not indicated the need for this.

The use of 5 per cent. malachite green as suggested by Schaeffer and Fulton for bacterial spores proves somewhat expensive if large numbers of slides are to be stained, as for example, in student laboratory exercises. It is possible to lower the concentration of the dye, and thus reduce the cost of the stain. This and other modifications have produced a staining technique with which we have had uniformly good results with spores of various yeasts. The brilliant contrast between the color of the spores and vegetative cells permits rapid identification, and is so striking that the novice experiences no difficulty in interpretation. In this laboratory, it has been much more successful than the technique of Gray[4] which employs a mixture of malachite green and basic fuchsin.

A number of modifications of the details of the Schaeffer and Fulton formula and procedure have been tested and the formula given below seems to be optimum. Considerable variation in the application of the solutions is possible, and may be necessary with individual cultures, but it is believed that the method suggested will fail only in rare instances.

---

[1] A. T. Henrici, *Bact. Rev.*, 5: 97–179, 1941.

[2] A. B. Schaeffer and M. Fulton, Science, 77: 194, 1933.

[3] J. L. Shimwell, *Jour. Inst. Brewing*, 44: 474, 1938.

[4] P. H. H. Gray, *Can. Jour. Research*, 19: 95–98, 1941.

The solutions needed are as follows: (1) 1 per cent. malachite green dissolved, without heating, in 1 per cent. phenol, and (2) 0.5 per cent. aqueous safranin. The technique suggested for yeast spores is as follows: prepare smear on clean slide, air dry and fix lightly with heat of a Bunsen flame. Cover entire slide with malachite green solution and steam (do not boil) with a low Bunsen flame for two minutes. Wash in a gentle stream of tap water for one minute. Counterstain for 30 seconds with aqueous safranin. Yeast spores, upon examination, appear green, while the asci are a deep pink. With this method, less satisfactory results are obtained with bacterial spores, but further studies are in progress with reference to this question.

L. S. McClung

Indiana University

ENZYMATIC CLEANING OF BERKEFELD CANDLES USED IN THE FILTRATION OF HUMAN BLOOD PLASMA

In instances where filtration was desired in the treatment of plasma it was observed that the pores of new filter candles would clog after slight use and would rarely recover their initial filtering capacities after cleaning and sterilization. Even though preliminary filtration processes were employed the filtering capacities of the candles continued to be impaired.

The filtration was accomplished by pressure in a stainless-steel pressure-chamber having a 10-liter capacity employing 8″ × 2″ Berkefeld candles. New Berkefeld "V" candles would filter about 6 liters of plasma before clogging. And new Berkefeld "W" candles would clog after 1½ to 2 liters of plasma passed through them.

The candles were treated by the following methods:

(A) 1. Backwashing with saline (0.85 per cent.) followed by a thorough scrubbing with a moderately soft brush. 2. Further backwashing with tap water while gently brushing the candle. 3. Boiling the candle in 2 per cent. washing soda for 30 minutes. 4. Boiling in tap water 30 minutes, changing water several times. 5. Cooling and brushing gently under tap water. 6. Backwashing with water. 7. Drying by suction for 10 minutes followed by exposure in a 100° C oven. 8. Sterilization in dry wall oven or autoclave.

(B) 1. Backwashing with saline (0.85 per cent.) followed by a thorough scrubbing with a moderately soft brush. 2. Further backwashing with tap water. 3. Boiling ½ hour in 1 per cent. sodium bicarbonate. 4. Boiling in two changes of distilled water. 5. Cooling and brushing gently under tap water. 6. Drying by suction for 10 minutes followed by exposure in a 100° C oven. 7. Sterilization in dry wall oven or autoclave.

After processing the Berkefeld candles by either of the above methods the "V" candles would only filter about 1 liter and the "W" candles about ½ liter before clogging.

To meet the existing problem the following technique of pepsin digestion was employed in the cleaning of the filter candles and has proven itself to be very satisfactory: Candles were backwashed with saline, followed by a thorough scrubbing with a moderately soft brush while flushing with tap water. The remaining water was blown out by compressed air and the candles submerged in a porcelain container[1] in which 0.5 per cent. pepsin (U.S.P. XI) had been dissolved in aqueous 1 per cent. hydrochloric acid (C.P.). The candles covered by the acidulated pepsin solution were incubated overnight at 37° C, thoroughly backwashed with water while being scrubbed with a moderately soft brush, the water blown out by compressed air, wrapped in heavy paper and sterilized in a dry wall oven or autoclave.

The "V" and "W" Berkefeld candles thus treated were capable of efficiently filtering 8 to 10 liters of human plasma using the positive pressure apparatus. The rate of flow of the "V" candle (one liter every 10 minutes) was approximately twice that of the "W" candle (one liter every 20 minutes).

Summary

Berkefeld candles clogged by human blood plasma were cleared by enzymatic action. Candles incubated in acidulated aqueous pepsin solution, thoroughly rinsed in water, dried and sterilized were capable of efficiently filtering 8 to 10 liters of human blood plasma.

Bernard Witlin

Board of Health,
Territory of Hawaii

---

[1] Vegetable pan from electric refrigerator was employed.

BOOKS RECEIVED

Luhr, Overton. *Physics Tells Why.* Illustrated. Pp. ix + 318. The Jaques Cattell Press. $3.50.

Mursi, Zaki. *Tables of Legendre Associated Functions.* Pp. viii + 283. Fouad I University, Zaafaran Palace, Cairo, Egypt.

Reed, Alfred C. and J. C. Geiger. *Handbook of Tropical Medicine.* Pp. ix + 188. Stanford University Press. $1.50.

Taylor, Lloyd William. *Fundamental Physics.* Illustrated. Pp. xii + 602. Houghton Mifflin Co. $4.00.

Wriston, Henry M. *Challenge to Freedom.* Pp. x + 240. Harper and Brothers.

SCIENCE

Vol. 98 FRIDAY, AUGUST 20, 1943 No. 2538

Research and Therapeutics: DR. AUSTIN E. SMITH 161

The Introduction of New Viewpoints and Scientific Concepts in General Botany: DR. J. FISHER STANFIELD 164

Obituary:
Leslie Tillotson Webster: DR. J. CASALS and DR. T. M. RIVERS. *Walter E. McCourt:* DR. LEWIS F. THOMAS. *Deaths and Memorials* 167

Scientific Events:
The Ross Institute of Tropical Hygiene; The Budget of the University of Wisconsin; Affiliated Hospital Units for Civilian Defense; The Association of University Professors of the Allied Countries; The British Standards Institution; A Research Committee on Climatology 168

Scientific Notes and News 171

Discussion:
The Mosses of Luray Cavern, Virginia: WALTER B. LANG. *The Heath Hen:* JAMES H. PANNELL. *Numbering Book Illustrations:* DR. ALBERT K. KURTZ and DR. JACK W. DUNLAP. *New Words in Science:* HAROLD WARD. *National Learned Society Groups:* DR. LOUIS C. KARPINSKI 173

Scientific Books:
Samuel F. B. Morse: PROFESSOR GORDON FERRIE HULL. *Alaska Diary:* PROFESSOR W. M. KROGMAN. *Timber:* PROFESSOR DAVID A. KRIBS 175

Societies and Meetings:
The Annual Meeting of the Royal Society of Canada: PROFESSOR DAVID A. KEYS 178

Special Articles:
The Production of Folic Acid by Rat Liver in Vitro: LEMUEL D. WRIGHT and DR. ARNOLD D. WELCH. *Distribution and Heredity of Variants of the Rh Type:* DR. ALEXANDER S. WIENER 179

Scientific Apparatus and Laboratory Methods:
The Demonstration of the Protozoan Parasite of Quail Malaria by Fluorescence Microscopy: ROBERT L. PATTON and ROBERT L. METCALF 184

Science News 8

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

RESEARCH AND THERAPEUTICS[1]

By Dr. AUSTIN E. SMITH

SECRETARY, COUNCIL ON PHARMACY AND CHEMISTRY, AMERICAN MEDICAL ASSOCIATION

DURING the year 1942 nearly one tenth of the entire population became a hospital bed patient. One person entered a hospital in the United States as a patient every two and a half seconds. Surgical operations were performed at a rate of one to each 5.6 seconds and the hospital birth rate exceeded three live babies to the minute.

This represents only a part of the total illness in this country and is, of course, only a fraction of the illness prevalent throughout the world. By the time the war is over such figures when compared to world-wide statistics will be infinitesimal. At the recent National Conference on Planning for War and Post-war Medical Services a number of papers were presented to show post-war medical needs. Obviously the papers could not be specific in details as exact estimates for post-war needs are impossible to determine at this time, but they did give an indication of the future enormous requirements from the drug manufacturers. Will the demands be met entirely by current drugs or will there be available a host of new agents? With American medicine encountering diseases alien to these shores through participation in world-wide health problems and the return of infected troops, new and more effective agents will have to be provided.

At present the drug-manufacturing industry is faced with many problems—two major ones are increasing reductions of certain basic materials and increasing demands for Lend-Lease, armed forces and civilian use. The probable needs in the early post-war period stagger the imagination. As each manufacturer will have to give careful thought to the optimal use of his supplies, there is afforded a good opportunity to discard old, outmoded and comparatively useless agents. Here is an excuse to bite a hand that offers food with no disastrous results. If these deletions are offset by the introduction of new and truly effective agents there will be nothing lost but much gained. Undoubtedly successful survival and expanded competition after the war will depend largely on the establishment and output of research departments. Recently we were told of a basic list of drugs which will be needed in occupied countries as they are liberated, that the pooled resources of the world will be taxed to the utmost and that the medical profession and medical resources of this country will be called upon increasingly to meet the needs of the world for medical care and medical services. If our own physicians, scientists and educators are sent elsewhere in the world to administer to the ill and to organize health and educational programs, American drugs will be in demand not only because of availability but also because of familiarity.

---

[1] Read before the 1943 Annual Convention of the American Drug Manufacturers Association, Chicago, May 3, 1943.

RESEARCH PARTICIPATION

The degree to which research is dependent on therapeutics and therapeutics on research is undeniably appreciated by the medical, dental and pharmaceutical professions and drug manufacturers. The needs for research and progressive therapeutics are evident. The physician and the drug manufacturer are responsible for the prevention, diagnosis and treatment of disease. Their course of action is equally evident. Circumspective thought must be given to the inadequacy of existing treatments, the development of new ideas, their laboratory and clinical trial, their practical application. If it is the duty of the physician to prevent illness, to supply proper medical care for those who are ill and to encourage medical investigation, is not the drug manufacturer faced with the same responsibility? If the health of a nation depends on medical attention, does it not also depend largely on those who supply part of the treatment? And if the medical profession on the firing line needs assistance, should it not be able to turn freely and expectantly to those in the advance supply line?

Often one is asked who should take the initiative in drug research, the physician or the manufacturer. The answer is simple: Every one capable of doing meritorious work should participate. No one will wait for his neighbor if there is sufficient interest in the project. This has been especially true in the last decade and will continue after the war. During normal times research provokes increased business and better health. During times of war it is a patriotic duty to increase research activity; new agents are needed; faster methods of manufacture are essential; better storage conditions are helpful. In the top-notch center such responsibility is shared by all participants as they are interested not only in progress in their respective fields but in survival of their own places in these fields.

There is more to research than developing a new extract or a synthetic compound. The new agent must be carefully studied in test-tubes, on bacteria or animals and in the human. Such studies are complete only when proper working facilities are provided. If the manufacturer has not the space, equipment or trained personnel, the work can be completed elsewhere. When there is joint research the drug house and the investigating physician have certain responsibilities to each other: these should be clear-cut and well understood before any action is begun; otherwise friction and discontent will develop.

Progress in therapeutics does not depend entirely on the development of startling new drugs. Contributions may be offered through studies on diets, atmosphere, clothing, habits; in fact anything which will aid in the prevention and treatment of illness and increasing life expectancy is worthwhile. Too often improperly trained or equipped groups spend prohibitive amounts of time and money searching for miracle agents which are beyond their scope and overlook something practical close at hand.

CHANGES IN THERAPEUTICS

There are many who fail to realize how much progress has been made in the last twenty years in materia medica. In a certain book published in 1899 may be found ingredients of compounds commonly used at that time. One "uterine tonic and restorative" contained unicorn root, catnip, cramp bark, mitchella, cohosh, cinnamon, orange peel, caraway, sugar, diluted alcohol and water. How much different was this formula from those used by civilizations many centuries older! While many such mixtures are still evident they are fairly rapidly disappearing, largely because of the demands of science and of the spirit of competition. In fact, how often to-day do we hear the term "uterine tonic and restorative." A "neuralgic pill" consisted of extract of hyoscyamus, extract of conium, extract of Ignatia bean, extract of opium, extract of aconite, extract of cannabis indica, extract of stramonium and extract of belladonna. A treatment for diarrhea and dysentery offered blackberry root, galls, cinnamon, cloves, mace, ginger, blackberry juice, simple syrup, glycerin and diluted alcohol. Remedies for "female disorders," asthma, baldness and "blood purifiers" contained no end of ingredients. Such mixtures were frequently used less than forty years ago, even though the treatment of disease is almost as old as man. It takes no trained eye to scan scientific literature and perceive that therapeutics has progressed by leaps and bounds in the last twenty years. Such progress has been born directly of research. Were it not for research the world would still be lacking serums and vaccines, sedatives, anesthetics, vitamins, anti-infective agents and countless other agents. Were it not for research there would be no high-caliber medical, chemical and other meetings, nor would there be the galaxy of published papers now at our command.

Expediting Research

Unquestionably there are delays in research and therapeutic advances—one of the greatest contributing factors is probably misunderstanding: misunderstanding by the physician, educational or research center and manufacturing directors of what a drug manufacturer is capable of doing; misunderstanding of what may be expected of and by an investigating clinician, chemist or pharmacologist or other scientist; and misunderstanding of what may be expected of and by a research center. Such misunderstanding has long served to perpetuate existing confusion, and yet it is surprising to observe how few attempt to ascertain and remove the cause of the confusion.

The first step for any proposed investigation is a consideration of the practicality of the problem and an outline of the program. Then must be determined the limitations of the investigator or the manufacturer. Frequently there is failure to realize existing potentialities and to make the most of these. Of equal frequency is failure to realize one's limitations and the end conclusion is a dismal lack of success or, at the most, uncritical results. Perhaps part of the fault lies in the assigning of incompetent individuals or groups to make the necessary surveys; such incompetence may exist any place along the line of proposed action. Unless the causes for confusion and misunderstanding are removed no individual or organization can hope to contribute the best to the maintenance or promotion of health.

Having decided what can be done, the next decision concerns how it can be done best. Frequently this raises the question of expansion. Expansion, whether it be by a drug manufacturer or by a center of investigation, must be made on a solid foundation. Sometimes expansion is impossible, in which case it is much better economically and otherwise to remain firm and avoid the risk of regression. Too often there is failure to realize that the promoter and investigator are best suited for a particular type of job which could make them outstanding in the one field but which would leave them far behind if they attempted to work in totally alien fields. It is through a proper evaluation of one's scope of activity that we expect to be able to shrug aside such headlines as the following that appeared in a recent trade journal, "German Economic War Purposes Holds World Chemical Control." In view of what has been observed of American drug ingenuity, how can any other nation hold chemical control unless that nation is deliberately permitted to do so? Cheerfully on the same day there appeared an article entitled "Anti-Malarial Ammunition. Synthetic Drugs Will Match Former Quinine Production in Curative Power." When one can speak of the manufacture of billions of tablets of atabrine, tons of vitamins and hundreds of tons of sulfonamides, things which have been developed within a few years, one realizes the tremendous possibilities of research and therapeutics. One has only to look at the statistics provided in bulletins offered by the Department of Commerce and the U. S. Tariff Commission to comprehend the diversity and enormousness of drug manufacture in the United States.

Cooperation

Perhaps the thing which is contributing most to the present stage of development is the close cooperation of various sciences and specialists. Engaged on common problems may be found biochemists, organic chemists, physiologic chemists, pharmacologists, immunologists, clinicians, pharmacists, dentists, etc. Truly no one individual nor any one science stands alone as they may have in the years gone by. Contributions to materia medica have been made by practically all sciences; in no other field is there any closer affiliation between varied interests. In no other field can racial and national differences be more completely forgotten. Undesirable secrecy is disappearing, distrust is showing hopeful signs of receding and ideas are exchanged freely in conferences and at scientific meetings. Daily there are appearing announcements of new drugs, new research, new sources of outlet and agreements with other nations to promote hemispheric trade. Cooperation with adequate evaluation of one's scope plus a fair amount of aggressiveness will provide more drugs, better therapeutic technics and opportunities to partake in the existing agreements and others which will follow. Willingness to cooperate on medical problems not necessarily restricted to this country can be a most forceful weapon in promoting international developments, understanding and good will.

Summary

Progressive therapeutics depends on research, but at the same time it is a marked stimulant for promoting research. Through research will come much of the post-war advancement which may occur in medicine and allied sciences, drug manufacturing and educational centers. Success and survival will depend not only on cooperation, leadership and a shrewd business sense but on an adequate appreciation of opportunities, limitations and the value of fostering research by providing grants and fellowships. Much material assistance can be provided with mutual gain for all participants when such fellowships are established. This gain may extend past current problems into life-long associations. If the manufacturer recognizes his *opportunities* and *obligations* and *forges ahead* to challenge or accept them instead of remaining on the defensive, there will be less likelihood of being fettered by purblind policies. Each one interested in research and therapeutics has responsibilities peculiar to himself, but there are few, regardless of occupation, who, at the completion of a job well done, does not feel as Pasteur, who said of the researcher:

> It is indeed a hard task when you believe you have found an important scientific fact and are feverishly anxious to publish it, to constrain yourself for days, weeks, years sometimes, to fight with yourself, to try to ruin your own experiments and only to proclaim your discovery after having exhausted all contrary hypotheses.
>
> But when, after so many efforts, you have at last arrived at certainty, your joy is one of the greatest which can be felt by a human soul, and the thought that you will have contributed to the honor of your country renders that joy still deeper.

THE INTRODUCTION OF NEW VIEWPOINTS AND SCIENTIFIC CONCEPTS IN GENERAL BOTANY[1]

By Dr. J. FISHER STANFIELD

CHICAGO TEACHERS COLLEGE

IN any consideration of the approach to be utilized in presenting general botany to students of random selection and average ability, it is obviously necessary to examine with care the general aims of such an offering. It is also necessary, in this transitional period in methodology, to examine critically all current tendencies and evaluate them; one must further correlate the last named with certain recognized, sound and acceptable principles of scientific instruction at the college level. Lastly, it is imperative that we interpret and apply all controversial procedures within the limitations of personnel and equipment of the average undergraduate college.

Work at the college level is not to be confused with that of elementary grades in which the teacher is concerned with immature, plastic minds. Neither is it to be considered as similar to that offered at the secondary-school level, in which we have no selection of students whatsoever other than natural and no aim other than very generally cultural. College botany is a course offered to at least a pseudo-mature student body in which some degree of selection has operated, since only a very small percentage of high-school graduates enter college. At the worst, we are thus facing a selected group of students who should begin to divorce themselves from an immature approach to their studies. The fact that only one per cent. of the students taking general botany continue in the subject for advanced work does not change the last statement to any degree. One cogent, major aim of teaching remains fundamentally the same: a flexible and inspirationally directed assimilation of factual data and principles of proven worth with applications to those life situations within the mental scope and experience of the individual in question; factual data with which to achieve a concurrently developed, intelligent, appreciation with a concomitant curiosity as to plants, their reactions to factors in their environment, and their economic or biotic aspects, *i.e.*, plant sociology.

With these fundamentals, the fad of the moment, the latest tendency (often revived) of the professional pendulum swinger in methods, is simply incorporated into the inescapable and irreducible fundamentals of any science—namely, the assimilation of sufficient data upon which to laminate intelligent concepts; the precursors of a lasting constructive curiosity fostered by *satisfaction* in mature achievement rather than the immature, rambling questioning of untutored minds. Thus, whether you are striving to develop a sense of citizenship, achieve indefinite sociological aims, or direct a student in the first steps along the road to a professional scientific career, it is here in this freshman course that we must somehow bring him to see the necessity of accumulating data, developing powers of observation, achieving mental discipline, correlating factual agenda with immediate and general environment, and, finally, bring about the development of an inherent appreciation and curiosity relative to the plant world—an inspiration for further work—a sense of the challenging problems within the field of botany and its varied fields of specialization.

---

[1] A paper presented at the Symposium on the Teaching of Botany at Dallas in 1941 before the Botanical Society of America and the American Society of Plant Physiologists.

College botany is in a state of flux and may it never become static. Students are adjusting themselves to a rapidly changing world; curricula are changing; progress demands a treatment of recent scientific advances as well as the more stereotyped textbook essentials—applications of new concepts to the fundamental agenda so well known to us all. It is with some of these concepts that we shall now proceed.

There is a wide gap between formal research—pure science—and the mental set of the average freshman. It is possible, however, to adapt modern concepts to the course of study and thereby bring to the student not only a greater appreciation of plant science and its ramifications but also the awakening of curiosity and the awareness of plants as entities—as complex organisms in a living world.

We can then consider the plant as a whole, as an entity, and interpret morphology, physiology, etc., as intergrading biotic, dynamic living forces. This work may be simplified greatly if the student himself actually grows and tends plants over a period of time. The Chicago Teachers College is fortunate in having available greenhouse facilities so that each student actually has the experience of tending seven square feet of soil from the preparation of the seed bed in the benches to the harvesting of fruit and seeds. Seeding, transplanting, potting, rooting of cuttings, soils and fertilizers, and factors of growth may be considered in one situation and the writer has yet to see the student who does not feel a just glow of pride in his achievements. In this particular institution this practical, horticultural experience is a part of the required course of study for every freshman and is thus carried into their ultimate professional activities.

It is thus possible for the student to observe, with proper suggestions, that the life cycle of a typical flowering plant is really a series of phases. From the germination of the seed the vegetative phase is observed with growth and accompanying activities. Buds arise and flowering proceeds with the stoppage of growth common to this phase as shown clearly in recent work with tomatoes. Then follows the production of the fruit with a quickened pulse, so to speak, and ultimately the senescence of this individual plant or its parts. Even though a student may not realize or grasp fully all the details in the limited time available, the seed of an idea is fixed; namely, the plant as a whole with integrating, though definite, phases of development. With even a low ebb of interest, the most negative student may note his mistakes in tending the plants, observe variations in the growth of different species, see aberrations in certain phases of growth due to critical factors, become sensitized to factors in general and thus conceive of plants as living, changing complexes passing through definite phases in their development and reacting accordingly. It isn't difficult for a student to understand germination, embryos and the origin of tissues when he sees them unfold before his eyes. He may even think of a plant as a result of its past rather than its present in having presented to him facts relative to induced phenomena at certain stages in its embryology; for example, light and temperature effects in photoperiodism and vernalization. One may gradually perceive that the study of growth is a study of the differences developing from similar cells arising in meristems and growing into various structures. Physiological changes in these cells can then be considered in terms of environment and heredity. The firing and stimulation of the imagination and the correlation of varied factual data in the mind of the student are of the greatest value in these considerations.

Germination of seeds in glass containers may be used as illustrative material for many of these phenomena; at least a cotyledon and plumule become realities. In lieu of greenhouse experience, if space is available, even a potted plant or an experiment in hydroponics is feasible. The latter is particularly appropriate in the light of common usage both commercially and in the home. An understanding of the simple requirements for fertilizers can be included, although more practical knowledge is gained from a study of soils. In any event, the actual growing of plants is a vital requisite for successful work in general botany and certainly for the introduction of much colorful and challenging data.

In connection with the morphology of seedlings and growth a student can comprehend the sensitive loci of stimulus and response in plants by the use of simple experiments. Simply placing a box over a plant or stringing a few light bulbs brings a vivid appreciation of the phenomena of photoperiodism, and the seasonal blooming of common garden plants becomes significant to the student. Shading a part of a plant definitely connotes transport of a hormonal stimulus or inhibition in plants. Seasonal variations are clarified and gardens become something more than simply aggregations of miscellaneous plants. The student again thinks of a plant as an individual with loci of responses and transport of chemical determiners; thus, subsequently, some form of concept relative to meristems, primordia and manner of growth gradually evolves. With mitosis as a requisite, the use of colchicine is introduced and, if successfully applied, evolution occurs in the morphological change of the tissues reacting and the vista of future economic possibilities spreads before them. Further types of induced mutations are but another step in the line of thought, and variations in turn are assimilated with enlarged understanding of progressive development; at least to a greater degree than before.

The concept of control of plant development by internal forces is one of fundamental significance. Hormones have become a by-word of the layman and vitamins are a part of the average vocabulary. Auxin, as a collective term, is used quite freely and will soon become a part of all courses. While it is not practicable to utilize auxin as such, there is no dearth as yet of synthetics. With the varied phenomena attributed to these complicated chemical factors—growth promotions, growth inhibition, differentiation of tissues, flowering, fruit development—the concept of hormonal control assumes significant proportions as a causative factor. The interrelations of plant parts may be stressed in this connection; this is a further approach to the concept of plants as entities.

Bud dominance is easily introduced in varied ways. Apical dominance in potatoes, for example, and its importance in planting can be stressed and in some instances chemicals may be used to break such dominance. Apical dominance and inhibition of later growth as illustrated in tree form are easily seen and the simple procedure of pinching back a plant grown in the greenhouse with the subsequent development of buds indicates a change in the hormonal balance; for example, a reversal of the floral to the vegetative phase with its concomitant growth as compared with the more static phase of flowering.

The rooting of cuttings with the appearance of adventitious roots brings the attention once again to hormones and vitamins. It is of never-failing interest to the student to observe the formation of roots on various plant parts by means of the rooting hormones. Synthetic hormones in lanolin paste brings roots from stems and with proper application brings prototropism into clear focus as shown by the bending of stems when hormones are applied. The action of hormones in geotropism then becomes more clear. To see roots growing and covering stems by adding a few milligrams of an acid to the soil is also striking. Once the concept of hormones is established, parthenocarpy may be introduced with varied materials in keeping with the latest findings. From this approach, pollination and fertilization assume realistic proportions since basic understanding is present. A seedless tomato—a swollen ovulary—and then economic applications and the experimental work on premature fall of fruits and the delay of opening of blossoms to avoid killing frosts. The plant sciences begin to assume significant aspects in the eyes of the student—a necessary and vital prerequisite for positive and challenging interest with a fixation of facts rich in either professional or cultural connotations.

In addition to these modern approaches, the subject of vernalization and dormancy is always of interest; all students respond to the unusual, and certainly the explanation of these reactions can not fail to fall into this category. In addition, it is not at all difficult to stress the economic aspects of such work; either the latter or its application and relationship to man as the perpendicular pronoun will achieve the same result. Common bulbs may be treated and certain aspects of dormancy in general may be clarified. Dormant twigs are always potent illustrative material with morphological applications. Many misconceptions born of extravagant claims relative to vitamins and hormones may be corrected in such studies.

In general, these engrossing applications, in addition to experience in the actual growing of plants as practiced in the greenhouse, have caused the plant as a whole to assume a colorful significance in the life of even a casually interested individual. An integration has occurred; roots, stems, leaves, flowers, fruits, seeds—the student has run the gamut of them all—has observed the plant in all its phases of growth from the first cotyledons to the achievement of its ultimate goal—the seed. Perhaps even a casual understanding of vernalization and respiration has brought to him a sense of the living qualities—the reactions of dormant embryos or partly stimulated embryos to factors in the environment. Primordia are not simply morphological units or divisions; they are regions from which develop the resultants of heredity and environment, shaped by factors controlled by hormo-vitamin combinations, possessed of a phasal ontogeny and in a constant stage of change—an individual living through the infinitesimally short interphase of an evolutionary sequence.

Perhaps none of us can achieve all these correlations; not all instructors, for example, can provide actual, continuous, hands-in-the-dirt experiences. This brief presentation is by no means complete; the instructor may add others in respective fields of specialization and adapt them to presentation of material. All of us can, however, amplify our fundamentals with modern approaches and concepts—glorify our essentials with inspirational explanation of observed phenomena and thus achieve in a mature fashion, in a manner in keeping with the intelligence of our students at the college level, those aims so briefly entertained in the opening paragraph.

OBITUARY

LESLIE TILLOTSON WEBSTER

1894–1943

LESLIE TILLOTSON WEBSTER was born in New York City on July 23, 1894. After graduating from Amherst College in 1915 he studied medicine at Johns Hopkins University, where he graduated in 1919. After one year in the department of pathology at Johns Hopkins Medical School, he joined the staff of The Rockefeller Institute for Medical Research in 1920; he remained at the institute, of which he became a member in 1934, until his death on July 12, 1943.

From the beginning of his scientific career, Dr. Webster was strongly attracted to the study of factors operating in the spread of infectious diseases in different kinds of populations. When he began his work it was a matter of common observation that epidemics arise in the midst of a population, reach a maximum and then, after killing a number of individuals, wane. The reason for this cyclic course was attributed to chance contact with an infective agent. It was assumed that a highly virulent strain of an infective agent overcame the resistance of equally susceptible individuals of a population, thereby starting an epidemic. Then, as the number of cases increased, the elimination by death of many individuals in the population took place accompanied at the same time by active immunization of those that had suffered a sublethal infection. It was assumed that such a process eventually brought to an end an epidemic, leaving behind only individuals with an increased resistance. In this conception of epidemics little attention was paid to the host factor. Dr. Webster's work proved that in a given population individuals differ greatly in their susceptibility to infection, and that the host factor plays an important role in the rise and fall of epidemics.

By careful and painstaking work Dr. Webster proved that individuals have different degrees of resistance and susceptibility to infection, that these qualities are segregable and inheritable and that strains of animals can be developed by proper inbreeding so that some are highly resistant while others are exceedingly susceptible. By using properly bred animals he proved that in an experimental epidemic there is no need for an infective agent of exceedingly high virulence in order to start an epidemic; it is sufficient that the number of susceptible animals constitute a certain proportion of the population. The epidemic continues as long as enough susceptible animals are present, and, when the number of susceptibles reaches a certain low level, the infective agent through lack of proper soil ceases to be active, thus ending an epidemic. The individuals surviving an epidemic are resistant, not through a process of active immunization but through their inherited qualities. This was Dr. Webster's fundamental contribution to epidemiology and one that has had a marked influence on all modern work on infectious diseases.

In the field of virus infections, Dr. Webster's contributions have been many and important, especially his studies on rabies. Through his investigations more accurate methods of diagnosis were developed and his studies on antirabic vaccines led to a better evaluation of their potency and to the use of ultraviolet light in their preparation. His studies of human encephalitides has thrown light on many problems in this field; he particularly showed the value of albino mice in investigations of these maladies.

At the time of his death Dr. Webster was fully occupied by the study of the influence of dietary factors on resistance and susceptibility to infectious diseases. It is most unfortunate that his death deprived him of the pleasure of harvesting the fruit of this work. To his friends and to those who had the great privilege of being associated with him in scientific endeavor, his death has caused an irreparable loss; his critical scientific qualities, his kindness and devotion to his friends will long be remembered.

J. CASALS
T. M. RIVERS

WALTER E. McCOURT

PRIVATE funeral services were held on June 1 for Walter Edward McCourt, assistant chancellor of the Washington University, St. Louis, who died suddenly of a heart ailment on May 30 at his home.

Dean McCourt, fifty-nine years old, had been a member of the faculty since 1906. He had been in charge of the department of geology and geography since 1907 and served as dean of the Schools of Engineering and Architecture from 1920 to 1928.

Besides being one of the most popular teachers at the university Dean McCourt was active in scientific and discussion groups, both of a local and national nature. He was a former president of the Engineers Club of St. Louis, and for twenty-five years served as secretary of the American Institute of Mining and Metallurgical Engineers for this district.

Born in Brooklyn, N. Y., he received an A.B. degree in 1904 and an M.A. in 1905, both from Cornell University. He joined the Washington University faculty the following year. He was first an instructor in geology; was promoted to assistant professor in 1907, to associate professor in 1912 and three years later to full professorship.

He was a celebrated authority and lecturer on volcanoes, national parks and mountains. His classes at the university were among the favorite science courses. During his travels he had collected a valuable collection of picture slides which he often used with his lectures.

LEWIS F. THOMAS

WASHINGTON UNIVERSITY,
ST. LOUIS

DEATHS AND MEMORIALS

DR. IVIN SICKELS, professor emeritus of geology at the College of the City of New York, died in his ninetieth year on August 5.

THE death is announced of Baron Gerard de Geer, from 1877 to 1924 professor of geology at the University of Stockholm, founder of the Geochronological Institute there and an authority on glacial and postglacial problems. He was eighty-four years old.

THE *Journal* of the American Medical Association reports that a public campaign to raise at least $300,000 to be donated to the University of Cincinnati College of Medicine as a fund dedicated to the memory of Dr. Mont R. Reid was opened on July 12. The fund is to be used to supplement the regular budget of the College of Medicine and is intended "to honor the memory of a great citizen, to advance the cause of medical science and teaching and to promote the health of our community." An annual deficit varying from $18,000 to $25,000 has been met usually through the personal efforts of Dr. Reid.

SCIENTIFIC EVENTS

THE ROSS INSTITUTE OF TROPICAL HYGIENE

IT is pointed out in *The British Medical Journal* that the part played by the Tropics in providing indispensable products of all kinds has never perhaps before been so forcibly brought to the notice of the public as now. Nor in this connection has the importance of malaria and the need for controlling this most deadly of tropical diseases been so clearly demonstrated. Measures of control of malaria have now been developed in many parts of the world, but in none has progress in this respect been more conspicuous than in India. Particularly has the work of the Ross Institute of Tropical Hygiene (India Branch) in the Indian tea, jute and mining industries been a striking example of such progress. We have previously drawn attention to the part played by the institute in coordinating the resources of individual interests in these industries and in organizing and developing systematic research and active prosecution of measures throughout the many gardens, estates and labor forces concerned. The *Journal* summarizes as follows the information given in the annual report for 1941–42:

> Among contributors to the cooperative action initiated by the institute are listed over twenty agents and companies controlling more than 200 estates, with a total acreage of nearly half a million; extracts from reports by medical officers and others give evidence of the scale and beneficial results of the measures undertaken. In the account of the year's activities malaria control naturally takes first place, and some interesting facts are given of the result of anti-malaria work on a number of estates. Methods of biological control have been widely made use of, because owing to their cheapness and permanent character such measures have largely eliminated the high recurrent cost of oiling schemes. There are now at least 4,000 miles of streams and drains on tea estates in which the breeding of *Anopheles minimus*, the chief malaria carrier in this region, has been controlled by the "dense shade" method, whilst the regular training and cleaning of streams and the institution of "flushing" devices and other anti-larval operations have been widely extended.
>
> Perhaps the most immediately interesting part of the report concerns the branch's activities in relation to the military situation in India. The invasion of Burma by the Japanese has introduced many acute problems, not the least of these being malaria in the frontier districts and among refugees passing into India by this route from Burma. Dr. Ramsay, principal of the India Branch, has with his great knowledge of the local malaria problems involved been able to give much help, at their request, to the military authorities. The branch has also been able to forward the war effort by providing trained Indian malaria surveyors. About 600 Indians, many of whom have volunteered for service, have now been trained at Ross Institute training centers. Several British medical officers formerly employed by the tea industry are also now, as a result of training and experience in anti-malaria work, rendering invaluable service as malariologists with the Army in different theaters of the war. The report notes the retirement for health reasons of Dr. David Manson, in whose laboratory at Cinnemara much research work has been carried out and over 200 malaria surveyors trained. Mention is also made of the very valuable results from the researches of Dr. Muirhead Thomson, of the London School of Hygiene and Tropical Medicine, upon the bionomics of the carrier species *A. minimus*, whose life history has been intensively investigated in the field.

THE BUDGET OF THE UNIVERSITY OF WISCONSIN

THE budget of the University of Wisconsin for the 1943–44 fiscal year, including funds for teaching and training on a twelve-months basis, was adopted by the Board of Regents at its last meeting.

The budget for the fiscal year, which began on July 1, amounts to $7,205,160 for all educational and general expenditures and for all extension and public service work.

The figure represents an increase of $453,284 over the budget for 1942–43—an increase made necessary largely because of the fact that the university is now operating on a basis of three semesters instead of two semesters each year.

Education and general expenditures for 1943–44 will amount to $5,573,928, while extension and public service funds amount to $1,631,232. Some of these funds come from the state, others are earned in the form of fees, etc., while the remainder is paid by the Federal Government for the training of armed forces.

The budget makes provision for the year-round teaching load for both civilian and military students. The estimated enrolment includes approximately 1,900 civilian students in the full summer semester, 1,500 in the six and eight weeks' summer session, 5,000 civilian students in the regular academic year beginning in September, and 1,500 military students.

Included in the later group are the army air forces meteorologists, navy engineers, army basic phase, army foreign area and language and both army and navy medical students. In addition to these military students, who will be pursuing regular courses of instruction, the university will continue to train about 2,000 navy radio operators, WAVES, SPARS and marine women, navy cooks and bakers, and navy pilot trainees for whom instruction is separately financed.

It is estimated, therefore, that the enrolment during 1943–44 will consist of approximately 5,000 civilian students and nearly 4,000 military students or a grand total of 9,000 students.

AFFILIATED HOSPITAL UNITS FOR CIVILIAN DEFENSE

IN the *Journal* of the American Medical Association for June 26, attention was called to the fact that two hundred and fifty-one hospitals and medical schools have been invited by the Surgeon General of the U. S. Public Health Service to organize affiliated hospital units of the Emergency Medical Service of the U. S. Office of Civilian Defense. Already more than a thousand physicians and dentists have applied for association with these units.

Members of the staffs of affiliated units are commissioned in the inactive reserve of the U. S. Public Health Service, generally with ranks equivalent to those of captain, major or lieutenant colonel in the Army. They remain on inactive status except when there is an emergency arising from an air raid or other grave wartime disaster. When called to active duty they then receive the pay and allowances of officers of equivalent grade in the armed forces. They are expected to furnish service only in their own or neighboring states, and their obligation ceases at the termination of the present national emergency. The nature of the service is recognized by authorization to wear a lapel button which indicates that they have enlisted for emergency service. They do not wear a uniform until called to active duty and need not purchase one unless directed to do so when called to active duty.

The Board of Trustees of the American Medical Association and the Directing Board of the Procurement and Assignment Service have authorized essential physicians to accept positions with these affiliated units. Some physicians have expressed the fear that acceptance of these commissions might involve them in a responsibility to the U. S. Public Health Service and might in some way encourage the acceptance by the profession of the proposed Wagner-Murray-Dingell bill. This is a misunderstanding. Those who become associated with affiliated units are under no obligation to serve in any other capacity, no matter what functions Congress may some day see fit to thrust on the U. S. Public Health Service. Duties of members of affiliated units are limited strictly to those which they have agreed to assume as a result of enemy action.

THE ASSOCIATION OF UNIVERSITY PROFESSORS OF THE ALLIED COUNTRIES

THE Association of University Professors and Lecturers of the Allied Countries in Great Britain, according to *The Times*, London, began at New College, Oxford, on July 17 the largest conference which it has held so far. The subject of discussion was the reconstruction of universities in the occupied and conquered countries of Europe after the war.

The conference, which was welcomed to Oxford by its president, Professor S. A. Glaser, Polish Minister to Belgium and Luxembourg, was given the Oxford background to its aims by the regius professor of modern history, Dr. S. M. Powicke. It will work in three main groups and many sections. The group dealing with arts will be under Professor J. A. Veraart, Netherlands; the group for science will be under Professor A. Photiades, Greece, and that on general subjects under Dr. Jean Timmermans, professor of physical chemistry at the University of Brussels and director of the Bureau of the International Union of Chemistry.

Among the subjects discussed were law, science and technology, economics, the modern humanities, history, medicine other than general science, and information for students. The meeting considered reports from the various sections which had been at work on the possibilities of setting up an educational clearing-house for Europe and the need for establishing an international body for information and coordination concerning inventions and discoveries.

Professor Timmermans, who is Minister of Public Instruction in the Belgian Government and who has been a vice-president of the association, was elected president.

THE BRITISH STANDARDS INSTITUTION

AT the annual general meeting of the British Standards Institution, which was held on July 20, according to the account in *The Times*, London, Sir Percy Ashley, the chairman, reviewed the present position of the institution and the work of the past year. In the course of his address he said that the 8,000 or so members of the committees of the institution who gave their time voluntarily, often traveling far without reimbursement of expenses, would feel gratified that the Government had recognized the institution as the sole organization for the issue of standards having a national application and that it had decided to increase substantially the grant-in-aid which, during the coming year, would be approximately £12,500 or nearly double the former grant.

He stated that there were in current use about 1,500 British standards, and during the year under review 230 new and revised standards or amendments had been issued. Complete sets of British standards were available for inspection at British diplomatic and trade commissioner offices in 16 centers in the British Commonwealth, two in the United States, six in South America, six in Europe, one in Egypt and one in Persia. The collaboration with standardizing bodies, overseas, in so far as conditions now permit, continues to develop steadily. Copies of overseas standards are available in the library of the institution.

Sir Percy pointed out that the institution could look back upon a year of continued progress and increased usefulness. He said:

> I believe that those industries which have been long and closely associated with the development of the institution recognize fully the advantage of having a single, independent, national standards organization. But those others which are only now beginning to consider the opportuneness of the time for a standardization program covering types and sizes, trade terms, definitions and performance standards, may feel that the preparation and promulgation of standards is a matter of purely domestic concern, and should therefore be carried out solely by their individual trade associations.
>
> There has also been some tendency for Government departments to do standardization work in their own ways and on their own lines. I believe that both those courses are wrong in principle, and that the best results for any industry, and certainly for the industry of the nation as a whole, will be obtained only if all this work is carried on within a national organization such as the British Standards Institution, which can coordinate and guide all such action to a common end.

During the past year the income and expenditure had increased by about 20 per cent., and amounted to some £53,000. The sales of British standards had gone up 57 per cent. The number of contributing members had increased by 15 per cent.

A RESEARCH COMMITTEE ON CLIMATOLOGY

A RESEARCH committee on climatology has recently been established in the Section of Meteorology of the American Geophysical Union by C. W. Thornthwaite, the president of the section. It is intended to be a working committee whose main aim is the fostering of active research in climatology and the exchange of ideas among climatologists. It considers its sphere of interest to lie mainly in (1) physical climatology, (2) microclimatology, (3) statistical climatology, (4) applied climatology and (5) climatological instruments. The committee will encourage climatological research of high quality in order to increase the existing body of knowledge in climatology and will endeavor to cooperate with workers in neighboring fields who are confronted with problems of climatological interpretation. Among these fields of application of climatic research are geography, synoptic meteorology, agriculture and biology, medicine and public health and various phases of engineering.

The scope of the committee, therefore, is conceived on a very broad basis, and while the actual work will shift in emphasis from time to time from one to another of these fields, it is not the intention of the committee to limit the activities of its members at any time. The membership of the committee is to be expanded gradually as the work develops. The committee now consists of the following members: Phil E. Church, Alfonso Contreras Arias, Woodrow C. Jacobs, Helmut E. Landsberg, *chairman*, John B. Leighly, Albert E. Parr, F. W. Reichelderfer, A. K. Showalter, Robert G. Stone, C. W. Thornthwaite and H. G. Wilm.

It is hoped that the committee may serve as a clearing-house for information on research in climatology actually in progress. One of its first objectives is, therefore, to find out what research is now under way. The committee hopes to obtain the names of persons and institutions now engaged in such research, and information on the character of the active projects. The committee intends to foster an active interchange of ideas through establishment of connections with these research workers. Machinery is being set up to prepare bibliographies on various phases of climatology. As the need arises subcommittees will be formed to deal with various special fields.

H. D. HARRADON,
Secretary, Section of Meteorology,
American Geophysical Union

SCIENTIFIC NOTES AND NEWS

Dr. Perrin H. Long, professor of preventive medicine at the School of Medicine of the Johns Hopkins University, is now a lieutenant colonel serving as medical director in the North African war theater.

Dr. Donald C. Balfour, director of the Mayo Foundation, has been elected an honorary fellow of the Royal Society of Medicine, London.

Dr. Alexey Nikolaevich Bach, biochemist of the University of Kiev, and Dr. Te-Pan'g Hou, Chinese industrial chemist, will be awarded honorary membership in the Society of Chemical Industry at a dinner meeting of the society to be held at the Waldorf-Astoria on October 22.

The Clarke Memorial Medal for 1942 of the Royal Society of New South Wales has been awarded to Dr. W. L. Waterhouse, of the University of Sydney, "in recognition of outstanding contributions in the sphere of natural science, particularly in plant pathology."

At a recent meeting of the Academy of Medicine of Cleveland, Dr. Howard Dittrick, for many years a member or chairman of the publications committee, was presented with the distinguished service award of the academy for 1943. The award consisted of a silver plate and went to Dr. Dittrick in recognition of his service to the academy over a long period of time.

The doctorate of laws of the University of Leeds will be conferred on Professor H. S. Raper, Brackenbury professor of physiology at the University of Manchester, and the doctorate of science on E. V. Evans, chairman of the British Gas Research Board.

A dinner in honor of Dr. Esther Rosencrantz, associate professor of medicine and lecturer in medical history and bibliography at the Medical Center in San Francisco, was given by fifty of her colleagues at the Palace Hotel on July 9 on the occasion of her retirement from the Medical School of the University of California after a service of thirty years. From 1920 to 1937, Dr. Rosencrantz was chief of the Tuberculosis Service at the San Francisco City and County Hospital.

The American Society of Naturalists has elected the following officers to serve for the year 1943: H. J. Muller, Amherst College, *President;* B. M. Duggar, University of Wisconsin, *Vice-president;* A. C. Kinsey, Indiana University, *Secretary;* and M. R. Irwin, University of Wisconsin, *Treasurer.* The following were elected members of the society: Ernest C. Abbe, LeRoy Abrams, F. A. Beach, J. P. Bennett, James Bonner, Ralph Buchsbaum, Earl O. Butcher, Fred K. Butters, Wanda K. Farr, David R. Goddard, Karl C. Hamner, Edwin R. Helwig, Hope Hibbard, Theodore L. Jahn, John S. Karling, Stewart A. Koser, Alfred M. Lucas, Gordon Marsh, H. M. Parshley, Frederick V. Rand, P. L. Risley, Ralph Singleton, J. M. Webber and S. H. Yarnell.

The interim Commission on Food and Agriculture, which was established by the United Nations conference at Hot Springs, Va., has elected as its permanent chairman L. B. Pearson, minister-counsellor of the Canadian Legation, and as vice-chairmen M. Pavel Tchegula, of the Soviet Purchasing Commission, and Tsou Ping-wan, of the Chinese Food Ministry.

Colonel Sir A. Stanley Angwin has been elected president of the British Institution of Electrical Engineers; T. G. N. Haldane and Dr. E. B. Moullin have been elected vice-presidents; and E. S. Byng has been elected honorary treasurer.

Dr. Earl O. Butcher, professor of biology at Hamilton College, a member of the faculty for fifteen years, has resigned to join the department of anatomy of the New York University College of Medicine and Dentistry.

Dr. Henry N. Harkins, of the Henry Ford Hospital, Detroit, has become associate professor of surgery at the School of Medicine of the Johns Hopkins University.

Dr. Eric Ogden, associate professor of physiology at the University of California at Berkeley, has been appointed professor of physiology at the School of Medicine of the University of Texas, Galveston, and clinical physiologist to the John Sealy Hospital. He has been associated with the division of physiology of the University of California since 1929.

Dr. Stewart C. Thomson, assistant professor of anatomy at the Loyola University School of Medicine, Chicago, Ill., has been appointed assistant dean of the school. He succeeds Dr. John G. Powers, who will enter private practice. Dr. Francis J. Braceland, dean of the Medical School, is now in the Navy. Dr. Amedeo S. Marrazzi, assistant professor of pharmacology at the New York University College of Medicine, has been appointed professor and head of the new department of pharmacology.

Ethelwyn B. Wilcox has been appointed assistant professor of nutrition at the Utah State Agricultural College at Logan.

Dr. O. N. Allen, professor of bacteriology and a former chairman of the department of botany of the University of Hawaii, has recently been named chairman of the newly established department of bacteriology.

THE U. S. Public Health Service has made a grant to Washington University to finance a cooperative study by Drs. M. Trotter and V. Lanier, of the department of anatomy, and Dr. Howard McKnight, of the department of obstetrics and gynecology, of the spinal dura mater and of the posterior surface of the sacrum in connection with the new method of continuous caudal anesthesia in childbirth.

DR. CHARLES S. HANES, chairman of the British Advisory Committee on Dehydration of the Combined Food Board, has been appointed director of food investigation in the Department of Scientific and Industrial Research.

DR. A. J. AMOR has been appointed chief medical officer of the British Ministry of Supply in succession to Air Vice-Marshal Sir David Munro, who has resigned to become medical adviser to the Ministry.

The Times, London, reports that Dr. C. M. Wenyon, F.R.S., will retire shortly under the age limit from the position of director-in-chief of the Wellcome Research Institution and director of the Wellcome Bureau of Scientific Research. His association with the laboratories, founded by the late Sir Henry Wellcome, has extended over thirty-six years. Dr. Charles H. Kellaway, F.R.S., director of the Walter and Eliza Hall Institute for Medical Research, Melbourne, will assume the directorship-in-chief of the institution and the foundation's other research laboratories as early in 1944 as possible. Dr. Wenyon has agreed to postpone his retirement until Dr. Kellaway reaches Britain. Dr. N. Hamilton Fairley, F.R.S., a director of medicine to the Australian Army in the Pacific, will eventually take over the directorship of the Wellcome Bureau of Scientific Research.

DR. IVOR GRIFFITH has been appointed research director of the Frank H. Lee Company, hat manufacturers, of Danbury, Conn. He will continue as dean of pharmacy at the Philadelphia College of Pharmacy and Science.

DONALD E. SHARP, formerly assistant to the vice-president and director of research of Hartford-Empire Company, of Hartford, Conn., has joined the Libbey-Owens-Ford Glass Company as assistant director in charge of glass technology.

DR. H. J. CHANNON, Johnston professor of biochemistry at the University of Liverpool, known for his work on fats and fat metabolism, has resigned to become associated with Unilever, Ltd.

MAJOR GENERAL JAMES C. MAGEE, a former Surgeon General of the Army, who has recently returned from a visit to the troops in England and North Africa, delivered on August 9 to the faculty and students of New York University College of Medicine a lecture on military medicine with special reference to tropical diseases.

THE Parsons Memorial lecture for 1943, given under the auspices of the Physical Society, London, will be delivered early in the autumn by Lord Rayleigh.

THE annual meeting of the American Psychological Association will be held at Northwestern University from August 31 to September 1. Owing to the serious crisis in the field of transportation it has been voted that council members only be encouraged to travel any distance to the annual meeting. Those in the immediate vicinity are invited to attend a "token" annual meeting. It is expected that most problems can be presented to the council by mail and that business requiring action can be handled by the emergency powers granted to the council at the last annual meeting if a quorum is not available. Other matters may need to be referred by mail to the broader base of associates and members. Headquarters will be maintained at Scott Hall. The council will be in session beginning on August 31 in the Hardy Lounge in Scott Hall. The "token" annual meeting is scheduled for Thursday, September 2, beginning at 1:30 P.M. in the auditorium of Lutkin Hall. It is expected that this meeting will be local and unrepresentative and that only those in the immediate vicinity whose presence will not tax the transportation system will attend.

The Times, London, reports that many leaders of British agriculture and representatives of twenty-eight nations gathered at Harpenden on July 27 to celebrate the centenary of Rothamsted Experimental Station. Welcoming the visitors at luncheon, Lord Radnor, chairman of the Lawes Agricultural Trust, said it was a matter of great pride to them that this was the first agricultural research station to celebrate its centenary. Lord Radnor paid a tribute to Sir John Russell, the retiring director. Mr. Hudson, congratulating Rothamsted on attaining its centenary, said "that phosphates had become the touchstone of agricultural production, and we owed the discovery of superphosphate to Sir John Lawes. Fortunately we were now receiving substantial imports of phosphate rock from North Africa, and this would be of great value in securing full crop output. Research was necessarily a long-term problem, and separate organization was needed to disseminate the fruits of research in practical knowledge among farmers." Sir John Russell expressed Rothamsted's pride in the world-wide recognition of the work of the past century.

AN expanded program of research through fellowship grants for the 1943–44 academic year has been announced by the Wm. S. Merrell Company, pharmaceutical manufacturers of Cincinnati. Research in organic chemistry, bacteriology, pharmacology and biochemistry will be conducted at Cincinnati, Cornell, Illinois, Indiana, Louisville, Michigan, North Carolina, Ohio State, Pennsylvania and Temple Universities, and at Kansas State Teachers College. Grants for clinical research fellowships have been made to the Chicago Maternity Center, the University of Cincinnati, Harvard University, the University of Louisville, the University of Nebraska, the Pennsylvania Post-Graduate Hospital, Wayne University and Washington University.

Nature reports that the National Research Council of Canada will award for the academic year 1943–44 fourteen fellowships of the value of $750 each, thirty studentships of $650 each and twenty-one bursaries of $250 each. The sixty-five successful candidates for these post-graduate scholarships comprise graduates of fifteen Canadian universities, and they will carry out research work in the coming year at eleven of these institutions. As a result of war conditions, the fields of science in which the scholarship holders will work are reduced in number as compared with a few years ago. By far the greatest number will work in various branches of chemistry related to the war effort. According to a general classification adopted in announcing the awards, forty-nine will study chemistry, six physics (including one radiology), four biochemistry, two genetics, and one each biology, mineralogy, mechanical engineering and electrical engineering.

DISCUSSION

THE MOSSES OF LURAY CAVERN, VIRGINIA

THE writer returned[1] to the Caverns of Luray in the Shenandoah Valley of Virginia in September of 1941 for a more complete sampling of the mosses that are now growing upon the floor, walls and ceiling of the cavern wherever artificial light has been cast in time and amount sufficient to cause germination of the moss spores. Through the courteous assistance of the cavern management a thorough examination of the cavern was made, and all specimens which to the unpracticed eye appeared to be different in any form or color were collected. Though it can not be claimed that the collection is complete, it should present, however, a fair cross section of the kind of mosses in the Caverns of Luray. The specimens were sent to Dr. W. C. Steere, of the University of Michigan, who has kindly provided the identifications given in the column in Table 1 under "plant."

TABLE 1

Station	Plant	Description
Ramble	*Leptobryum pyriforme* (Hedw.) Schimp.	One-inch long thin stems, spare of leaves
Cross of 8	*Bryum pseudotriquetrum* (Hedw.) Schwaegr.	¾-inch long stems, well covered with leaves
Cross of 8, ground light	Moss—sp.?	2-inch long stems, luxurious leaf development
Mirror Lake	*Ceratodon purpureus* (Hedw.) Brid.	½-inch fine stems, small fine leaves
Entrance wall, 12 feet above floor	*Eurhynchium serrulatum* (Hedw.) Kindb.	Stems an inch or more long, quite leafy
Dream Lake	*Bryum pseudotriquetrum* (Hedw.) Schwaegr.	Long stems, leafy
	Weisia viridula (Hedw.)	Very short tight bunches of stems, leafy
	Thuidium sp.	Long stems full of tightly packed leaves
Ramble—ceiling	Algae	Minute filaments, fraction of mm long

It is interesting to note that algae were found tenaciously growing to the limestone ceiling as a thin, compact, dark-green matte and under the same conditions as the mosses.

Supplemental samples of the moss specimens were spread between blotters and packed away at the time they were collected. When the containers were opened after the specimens had been more than a year without light or moisture they were found to be as green as ever.

Some two years ago the new Skyline Caverns near Front Royal, Va., were opened to the public after having been equipped with a modern lighting system. I was privileged at the time to make a thorough examination of the cavern for evidence of moss but found none except in the entrance corridor in the immediate vicinity of lights that are allowed to burn more or less continuously. This new moss growth appeared like a faint green fuzz upon the limestone. In time, it is expected that mosses will germinate within the cavern where the large projectors have been placed.

Dr. Frans Verdoorn has recently brought to my attention a paper by Jacques Maheu on American cavern flora[2] in which he presents some interesting conclusions regarding a comparison of American and European cave flora. Maheu states that the flora of Kentucky caves and those of Europe are the same and deduces therefrom that it is possible to establish one classification of cavern flora which will be universally applicable regardless of country or climate. He notes that American forms are more reduced and less varied, but that the variations are absolutely parallel with those of Europe; sterility, lengthening of the leaves, wider spacing of the leaves on the stems, elongation of the cells and disappearance or thinning of the nerve. The two most important factors in bringing about this transformation of plant life entering the environment of caves are humidity and reduction or total elimination of light. He further emphasizes the fact that of the American caves he has visited, he did not find the flora as rich as that of Europe and the neighboring species, but more transformed.

---

[1] Walter B. Lang, SCIENCE, 94–2444, p. 414, October 31, 1941.

[2] La flore cavernicole américaine (Grottes de Mammoth-cave et de City-cave, état de Kentucky), *Bull. Soc. Bot. de France*, 63: 39–57, 1926.

One wonders whether the flora in large caverns in the desert area of southwestern United States has not been more transformed where the humidity of the upper part of the cavern is affected by the regional environment.

Walter B. Lang

U. S. Geological Survey

THE HEATH HEN

This is rather a belated attempt to draw attention to one of the statements made by Dr. W. C. Allee in his article published in Science for June 11 in which he cites safety in numbers as one of the evidences of natural cooperation. This is one of the most important principles of conservation and one which should be driven home to all Americans. I do not think there would be a better way to explode the idea that a single pair of animals can regenerate a host of the species than to quote from another publication of Dr. Allee's, "The Social Life of Animals," discussing the fate of the heath hen.

> The heath hen was most abundant in Massachusetts, but by 1850 it had been killed off until it was to be found only on Martha's Vineyard and nearby islands and among the pine barrens of New Jersey. By 1890 to 1892 the birds had diminished to a scant two hundred at most, restricted to Martha's Vineyard. As soon as the "bird stuffers" heard how rare they had become, prices went up and museum collectors rushed in to get specimens before they disappeared like the dodo. By 1907 the count had been reduced to seventy-seven. The Heath Hen Association was formed. The society arranged for almost three thousand acres of protected range for the birds. By 1916 their numbers had increased to two thousand.
>
> Then came a fire, a gale, and a hard winter, with an unprecedented flight of goshawks, and in April, 1917, there were fewer than fifty breeding pairs. The next year, when there was an estimated total population of one hundred and fifty, the heath hen range was invaded by several expert photographers who took motion pictures of mating behavior. In the face of this disturbance at a critical time, still a good year allowed the birds to increase and again spread over Martha's Vineyard. In 1920 three hundred and fourteen were counted; but thereafter a decline in numbers set in which was never stopped.

In spite of increased measures of protection, the census for the succeeding years were 117, 100, 28, 54, 25, 35. The last one seen was a banded male, in 1932. These facts clearly point out the folly of waiting until near extinction before preserving a species.

James H. Pannell

NUMBERING BOOK ILLUSTRATIONS

The writers have a particularly good reason for agreeing *in toto* with the suggestions made in Lewis G. Westgate's article, "On Numbering Book Illustrations."[1] Eleven years ago we employed the principle now sponsored by Westgate of numbering tables and nomographs according to the page on which they occur.[2]

From the point of view of both author and publisher, more work is involved in numbering the table that is found on page 86 as Table 86. Comments we have received indicate that, from the reader's standpoint, this extra work is amply justified. We join with Westgate in hoping that an increasing number of authors will see that the figures, tables, etc., in their scientific texts and reference books are referred to by their page numbers.

Albert K. Kurtz

Life Insurance Sales Research Bureau,
Hartford, Conn.

Jack W. Dunlap

University of Rochester

NEW WORDS IN SCIENCE

I was very much interested in a recent letter in Science by E. F. McDonald, Jr., discussing the new word, *Radionics*. As science editor of the College Standard Dictionary, now undergoing a thorough revision, it is a good part of my job to watch for, track down, estimate and define the hundreds of new terms being introduced into the various sciences, both theoretical and applied. Mr. McDonald's comments on *Radionics* sent me on a hunt through various current sources, but with disappointing results. I have not succeeded in finding the word in actual use in the few technical journals I have seen, including the *Review of Scientific Instruments, Science News Letter,* the *Journal of Chemical Education* and a number of recent books.

I wonder if any of your readers could supply me with further information on the origin, date of first use, originator, range of usage, etc., regarding this very expressive term? The status of the men who favor it over *electronics* (which I still find used rather extensively) suggests survival value and naturally I am anxious to see that it has the proper rating in our dictionary, along with a respectable number of other new terms, such as *vitamer, betatron, tectonophysics, paleopedology* and *geotechnology.*

It has long seemed to me that both scientist and layman would be greatly benefited by a more intelligent and comprehensive treatment of what I like to call the language of science. Especially does this seem desirable in the general dictionary, as distinguished from the many technical glossaries accessible to—and often understood only by—trained specialists. In my personal files, as well as in the master files in the Funk and Wagnalls reference department, are hundreds of cards dealing with this field of knowledge alone. The material, indeed, is so rich, and it accumulates so rapidly, that I have been encouraged to compile a sort of annual glossary of new (or relatively new) scientific and technical terms, the first modest instalment of which appeared in the 1943 edition of the *New International Year Book.*

---

[1] Science, 96: 581, December 25, 1942.

[2] J. W. Dunlap and A. K. Kurtz, "Handbook of Statistical Nomographs, Tables, and Formulas." World Book Company, vii + 163 pp. 1932.

I hope that some of your readers with a flair for the terminology and nomenclature of the sciences may feel prompted to comment on the points raised in this letter, possibly even contributing such new terms as they consider important for the proper understanding of new developments in their own fields. It is true, as Faraday sensibly remarked, "that names are one thing and science another"—but was it not Faraday who gave us *electrolyte, anode, cathode, electrode, ion?* And, despite Mr. McDonald's plea for *radionics,* how large is the language-debt of science to Johnstone Stoney's fertile neologism, *electron!*

Harold Ward

New York, N. Y.

NATIONAL LEARNED SOCIETY GROUPS

In my article "National Learned Society Groups" (Science, May 7), by some slip of the pen, I inadvertently mentioned the Geological Survey, intending to cite one of the Government Bureaus specifically mentioned before a House Committee by Secretary of the Interior Ickes. Actually the Survey is one of the few departments requiring of its staff, I am now told, a written statement of freedom from any paid connection with private corporate interests. I have been assured that this measure is strictly enforced, requiring rigid devotion in scientific matters connected with geology to the national interest. If all scientific departments of the nation and of the separate states, together with all colleges, universities and technical schools had this freedom from any private corporate connection my proposals would be superfluous.

Permit me to say that I have had scores of letters of approval and a score of interviews with supporters of my propositions; these include men in practically all the larger Eastern institutions as well as many in state universities, government bureaus and even from the far-off Oriental Institute of Oriental Studies in the Hebrew University of Jerusalem.

There have been four letters in opposition. I note that none of the objectors mention whether they have such paid connections with corporations.

Louis C. Karpinski

SCIENTIFIC BOOKS

SAMUEL F. B. MORSE

The American Leonardo. A Life of Samuel F. B. Morse. By Carlton Mabee. 32 and 380 pp. New York: Alfred A. Knopf. 1943.

From the brilliant introduction by Professor Allan Nevins to the final of the 380 pages by the author the reviewer found this to be a highly interesting and informative book. The 1875 "official" biography by Prime (nearly 800 pages) is very largely filled with long letters by or to Morse and with copies of documents bearing on the story of the telegraph. But in this book the author has seized upon the salient points of many letters and documents even more than were known to Prime and, with occasional quotations, has painted a portrait rich in color, accurate in detail. Every important statement concerning Morse is documented; that is, a reference to the original source is given so that the reader may, if he wishes, verify its accuracy. These references (40 pages at the back of the book) number about 740, but one reference may contain a list of several sources so that the total number of documents to which the reader may refer runs into the thousands. However, there is unity, continuity, alluring appeal and literary excellence in the body of the book.

This is more than a biography of Morse; it is a story of his time. For here we get glimpses of many of the prominent men with whom Morse had contact: His father, the Reverend Dr. Jedediah Morse, the stern, just Congregational minister, the author of the first American geography, a founder of the American Board of Foreign Missions, projector of the Andover Seminary; the foremost painters Stuart, Copley, West, Trumbull; the foremost scientists Silliman, Day, James Freeman Dana, Oersted, Ohm, Henry, Wheatstone, Arago, Ampere; the writers, Coleridge, Bryant, Cooper; the inventors, Whitney, Fulton, Daguerre, Steinheil; the statesmen, President Monroe, many members of Congress, Lafayette. We follow Morse as a struggling painter with a great ambition to paint historical scenes but compelled by poverty to paint portraits, at times, 14 hours a day. In the book there are sixteen excellent reproductions of paintings by Morse, chiefly portraits. They help to confirm the view, which many artists hold, that Morse was one of the foremost portrait painters of his time, comparing not unfavorably with Gilbert Stuart. We see Morse as a public-spirited citizen, a leader in the Nativist movement, a forlorn hope candidate for the mayoralty of New York. We note his fight against the O'Connel Guards, a military order of the Irish in New York, a forerunner of the German American Bund. We see him greeting the invention of the daguerreotype with great enthusiasm. He "saw in the image of a spider's head, no bigger than a pin, a minuteness of organization which he believed had not hitherto been known to exist. The discovery would open a new field of research, he predicted, with results as startling as when the microscope first came into use." He was one of the first American photographers. Then comes the great story of the beginning of the telegraph, and the Atlantic cable, the ridicule heaped by members of Congress on the idea of communicating intelligence through considerable distances by means of electric signals ("Senator Smith studied Morse's face for signs of insanity"), the successful experiment and the world's extravagant acclaim.

The author is critical in his appraisal of Morse as a scientist, but he gives a few quotations of the findings of scientific bodies. These make it clear that though Morse was not the sole inventor of the telegraph, he was the inventor of the Morse *method* of telegraphing—the method that has survived, with slight modifications, through these hundred years.

The reviewer has one mildly adverse criticism. It is in regard to the title. "Why drag in Velasquez?"—in this case, Leonardo? True, Morse called attention to the fact that artists may have abilities along various lines. He named Leonardo as a conspicuous example. Prime also names Leonardo as a scientist-artist, similar to Morse. But though there are points of similarity there are also great differences. Think of the origin of the two men. Think of Morse, the New England Puritan, the lifelong uncompromising foe of low standards in human conduct—then compare him with Leonardo. The author must share the view that there is an important difference, for there is probably more than mirth in his statement concerning Morse's friend and teacher, "Allston (a Southerner) was a Godfearing man, even compared with New Englanders." So where does Leonardo stand?

The book brilliantly bears out Professor Nevin's statement, "The life of Samuel F. B. Morse . . . is fascinating partly because of the versatility of his undertakings, partly because of the rich interest of his mind and character."

GORDON FERRIE HULL

ALASKA DIARY

Alaska Diary, 1926–1931. By ALEŠ HRDLIČKA. The Jaques Cattell Press, Lancaster, Pa. xv + 414 pp., with 232 illustrations. 1943. $5.00.

WERE it not for gas rationing and military priorities this book would precipitate a traffic jam on the Alaska highway. Dr. Hrdlička is careful to point out that there are other spots in the world for greater adventure, yet his clear style paints an intriguing picture of Alaska as offering the challenge of a frontier. The book is a diary of his archeological expeditions to Alaska, Yukon, Kuskokwim River and Nushagak, but it tells far more than the mere recovery of stone tools and human bones. It tells much of the living people of Alaska; it tells of the weather, of food, of transportation; it tells of opportunities, of hardships; and always it tells of Alaska, our far northwest border-country. Dr. Hrdlička went on these expeditions not as an "adventurer" or "explorer," but as a trained observer seeking to learn more of natural laws, especially as related to man and his prehistory. The volume is not an epic with pretense to literary grandeur; it is the day-by-day record of a simple unassuming man who looked, listened and stopped to learn.

On the expeditions Dr. Hrdlička collected nearly 4,000 crania and skeletons and measured many living. From the study of these data he concluded that "the entire littoral region of northwestern Alaska north of the Yukon, the habitable islands of the Bering Sea and the lower portions of the three large rivers appear to have always been occupied by the Eskimo." No trace of any other type of man has been found here. The upper reaches of the Yukon, the Kuskokwim and Nushagak were always sparsely occupied by Indians.

The Eskimos are not homogeneous, probably traceable to "a number of strains" in Asia. Three subtypes are recognized among the Indians: (1) the Yukon, Tananá and upper Kuskokwim; (2) Shageluk-Slough; (3) the Chugatchi to the south of the Nushagak. There are no distinct lines of demarcation between Eskimo and Indian types, although extremes in each are readily distinguishable, one from the other.

Dr. Hrdlička concludes that no mass migration came over from Asia. Rather, "the Asiatics came in dribbles," along the coast and a bit inward at river mouths. As to the time element, he concludes that "it could not be called very ancient, not reaching perhaps beyond the earlier parts of our era."

The publishers are to be congratulated upon their technical skill. The book is printed upon excellent paper and the illustrations, mostly photographs by the author, often taken under adverse lighting conditions, are well reproduced. The author is to be congratulated upon a fascinating record of scientific observation. It probably won't rank with the "Voyage of the Beagle" in importance, but it certainly evidences the same motivation of intellectual and scientific curiosity.

Wilton Marion Krogman
University of Chicago

TIMBER

Timbers of the New World. By Samuel J. Record and Robert W. Hess. xv + 640 pp., 58 plates, 75 figs., 8 maps. New Haven: Yale University Press. 1943. $10.00.

"Timbers of the New World" is the successor to but not a second edition of "Timbers of Tropical America," published in 1924. The new work contains more than twice the amount of material as in the old and is treated differently. In the old work a detailed macroscopic description is given for each individual wood with very little anatomy. Since the publication of "Timbers of Tropical America," Record and Hess and other investigators interested in the comparative anatomy of wood have devoted more time to detailed anatomy. However, in order to limit the descriptions of so many woods to one volume, the old plan could not be adopted for the new work because its field is extended to include species north and south of the tropics of the entire Western Hemisphere. This is the first attempt by any one to deal with all the larger woody plants of the Americas.

The new work is an encyclopedia of the best information available concerning the trees and larger shrubs native to South America, Central America, Mexico, the West Indies, U. S. A. and Canada. There are descriptions of the trees and woods of more than 1,100 genera and 155 natural families. For convenience of the reader the arrangement is alphabetical by families and genera. Under each family is listed the number of genera and species, their geographic location and a general description of flowers, leaves and fruit. The genera of greatest economic importance are emphasized. There follows a general macroscopic description of the woods. In fine print is given a detailed anatomical description of the family by genera followed by a reference such as that given for the Anacardiaceae: "For anatomy of the different genera see Tropical Woods 60: 16–45." Following the anatomical description of the woods of the family the various genera are listed alphabetically. Under each genus are given the important economic species with descriptions of the tree, flowers, fruits and leaves, and a macroscopic generic description of the woods. The important economic products such as drugs, oils, resins, fruits, etc., together with the uses of the woods are listed for each species. At the end of each generic account is given an alphabetical list of trade and common names for the woods by countries.

The latest accepted terminology is used doing away with much confusion which existed concerning the nomenclature of certain genera, such as: *Tecoma* and *Tabebuia* in the Bignoniaceae; certain species of *Cordia* in the Boraginaceae; *Amburana* and *Torresia*, *Cajoba* and *Pithecolobium*, *Libidibia* and *Caesalpinia*, *Vatairea*, *Andira* and *Tipuana* of the Leguminosae. Other examples could be mentioned. Furthermore, the botanical identities of timbers which have been known to commerce for a long time, such as Cocobolo, the Rosewoods, Brazil wood, Kingwood, etc., have been cleared up.

In recent years certain investigators have attempted to correlate anatomical characters of the stem with gross morphological characters in a natural system of classification. Toward this end the results obtained from anatomical studies, approached from the point of view of phylogeny, have given striking results. The authors state in the preface:

> Taxonomic botanists base their concepts of families, genera, and species on morphological characters of the reproductive and vegetative parts of a plant, and are not always in agreement as to the constitution of particular groups. . . . The present authors have considered these taxonomic problems from the standpoint of wood anatomy, and when confronted with alternative proposals by different botanists, have made their choice on the basis of anatomical characteristics.

As an example, the species of *Picrodendron* have been variously referred to the Juglandaceae, Anacardiaceae, Sapindaceae and Simarubaceae, are similar in wood structure, and do not indicate close affinity to any of the four families to which the genus has been referred. The genus, therefore, has been placed in the family Picrodendraceae established by Small in 1917. Several other examples concerning inconsistencies in current classification are called to the attention of specialists in those groups.

Toward the end of the book is an explanation of the terms used in the wood descriptions. The terms are illustrated with 75 excellent photomicrographs prepared especially to show variety of anatomical details. Also at the end of the book are lists of families classified with reference to special properties and uses of their bark, leaves and timber. The special lists are designed for convenience in locating trees and woods having special properties and uses or suitable for the same purposes as better-known kinds. The wood descriptions are based upon specimens in the collections of the Yale School of Forestry. The total number of samples available for comparative study is about 40,600, of which 22,000 are American. At the end is a complete bibliography of the principal publications arranged by countries.

The book is indispensable as a general reference for taxonomists, teachers and students of economic botany and wood technology, and others who are interested in the economic products of the forest, including wood utilization.

DAVID A. KRIBS

SOCIETIES AND MEETINGS

THE ANNUAL MEETING OF THE ROYAL SOCIETY OF CANADA

THE annual meeting of the Royal Society of Canada was held at McMaster University, from May 25 to 27. The scientific sections of the society held their meetings in the Science Building of the university and the general meetings took place in Convocation Hall. The president of the society, Professor J. B. Collip, F.R.S., presented the medals at the evening meeting on May 25. The Flavelle medal was awarded to Professor B. P. Babkin for his outstanding work in analyzing the secretory mechanism of the digestive glands. Professor John L. Synge received the first award of the Henry Marshall Tory medal for outstanding contributions to applied mathematics, and the Willet G. Miller medal, also awarded for the first time, was presented to Professor Norman Levi Bowen in recognition of his contributions to geology. Following the presentation of the medals, Dr. Collip read his presidential address on "Science and War." After briefly reviewing the part played by science in former conflicts, Dr. Collip emphasized the important contributions of physicists, chemists and other scientists in the present war. He dealt in some detail with aviation medicine and the cooperation between the men of science and the armed forces in solving many of the problems which modern warfare presented. He referred to the recognition and support that scientists were now receiving as an integral part of the war effort and pointed out that much of this research work is producing results that will be equally important in the post-war period.

A further feature of the meeting was the symposium, held after the dinner on May 26, on "Medical Investigations as Applicable to the Armed Forces," at which Surgeon Captain A. McCallum, Medical Director General of the Royal Canadian Navy, spoke in general terms of the organization for research in this service and of the work already accomplished. Surgeon Commander C. H. Best, F.R.S., director of the Royal Canadian Naval Medical Research Unit, gave a more detailed account of some of the results achieved in connection with nutrition, night-vision and similar problems. Brigadier J. C. Meakins outlined briefly the medical research going on in the army and Group Captain J. W. Tice, director of Medical Services (Air), spoke of some problems of interest to the Air Force in particular. This was followed by Squadron Leader K. A. Evelyn, who discussed in further detail many of the special problems in aviation medicine, at the conclusion of which he showed a moving picture film entitled "Oxygen." This film was shown as a special feature, permission for which had been specially granted. The film was prepared under the auspices of the Associate Committee on Medical Research of the National Research Council for use in training enlisted aircrew in the essentials of physiology and the effects of high altitude flying, pointing out the importance of the special precautions required.

Professor J. K. Robertson delivered the presidential address in Section III (Chemical, Mathematical and Physical Sciences) on "The Role of Physical Optics in Research," in which the speaker reviewed the discoveries into the nature of light, atomic and molecular structure and in astronomy that have resulted from the application of physical optics in spectroscopy, interferometry and diffraction. This historical account was followed by an address on "Chemical Reactions of Excited Atoms," by Dr. E. W. R. Steacie, and a paper on "Molecular Spectra and their Applications," by Dr. Andrew McKellar, who spoke particularly of applications in astronomy. Thirty-eight papers were presented to the section, the majority of which were read by title. Owing to the pressure of war work few physicists and chemists were in attendance, but mathematics and astronomy were well represented. Among those papers which were read, mention may be made of a few of some general interest. Professor Lachland Gilchrist and J. W. Britton gave an account of further experiments on the use of drill holes in electrical methods as an aid to the location of mineralized bodies and rock structure. Dr. J. A. Pearce announced the orbital elements of H.D. 222107 lambda Andromedae as revised on the basis of recent measurements and also the orbital elements of the spectrographic Binary H.D. 34333. A paper of particular interest was given by Dr. L. M. Pidgeon on the production of light metals, in which he reviewed the methods for the separation of magnesium and the difficulties which had to be overcome. He gave an account of his own experiments which resulted in the present method used in obtaining large quantities of magnesium metal in Canada since the outbreak of hostilities. Dr. H. F. Manske and L. Marion reported the isolation of eight alkaloids from *Lycopodium annotinum* L. Several papers were presented by Dr. Paul E. Gagnon and his co-workers, among which mention may be made of one in which the isolation of some new sulfamides in the 1-1-Diphenylindane was announced. Perhaps the most interesting paper presented to the section was one of those given by Professor E. F. Burton, in which J. H. L. Watson showed how stereoscopic photographs had been taken with the electron microscope and exhibited several examples to the members present. This new technique enables one to view the objects photographed so as to bring them out in three dimensions, thus adding depth to the pictures and revealing new features in the structure of smoke and metallic particles. At the conclusion of the sectional meetings, Professor T. Thorvaldson was elected president of the section for the year 1943–44.

In Section IV (Geological Sciences), Professor M. B. Baker gave the presidential address and spoke on "Gold and Iron Prospects in Canada." This address was followed by sixteen papers on various geological investigations. Among these Dr. E. A. Hodgson delivered a very interesting paper on the "Rock Burst Experiments at Lake Shore Mines, Kirkland Lake." The author outlined the program of the investigations carried out since 1939 and gave some of the results already obtained. Equipment has been designed to pick up, amplify and record the small subaudible snaps which occur in a rock under pressure and which increase in number as the pressure increases. The records of a severe rock burst which occurred on January 29, 1943, show conclusively that the method clearly delimits the area under pressure to within a hundred feet or less. So far, attempts to predict bursts as to time have not been successful; but it is hoped that further work will result in some measure of time prediction.

Professor G. B. Reed, president of Section V (Biological Sciences), spoke on "Wound Infections and Local Chemotherapy." This paper dealt with the treatment of wounds with the sulfa drugs and the speaker emphasized the necessity of applying the drug as soon as possible after the wound has been inflicted in order to obtain the greatest benefit. Fifty-six papers were presented to this section, many of which will appear in scientific journals. Space permits the mention of the two invited papers only. The one by Dr. Babkin, on "Secretory Mechanism of the Digestive Glands," contained a survey of the work of his laboratory on this subject. Briefly it might be stated that the investigations established that the mucous, demilune and myo-epithelial cell groups of the submaxillary gland each have a separate innervation, and that the surface epithelium cells of the gastric mucosa and the mucoid, peptic and parietal cells of the gastric glands are under independent nervous or humoral control. The conclusions to be derived from this work were stated and further analysis of the secretory function of the digestive glands given. The second paper, by Professor G. W. Scarth, on "The Mechanism of Frost Resistance," contained an account of the modes of frost injury to plant cells and of the protoplasmic changes which accompany frost-hardening. He also discussed how the different hardening changes afford protection. The new president of this section is Professor H. S. Jackson.

At the general meeting of the society, Monsignor Olivier Maurault, rector of the University of Montreal and a fellow of Section I, was elected president of the Royal Society of Canada and Professor J. K. Robertson was elected vice-president.

DAVID A. KEYS

SPECIAL ARTICLES

THE PRODUCTION OF FOLIC ACID BY RAT LIVER IN VITRO

A PRELIMINARY study,[1] using *Streptococcus lactis R*, indicated that the urine of man contains only very small amounts of folic acid. We have found, using *Lactobacillus casei*, that the daily urinary excretion of this factor by 15 normal individuals, based on the assay of 42 samples, averages 0.0108 mgm units (0.0038 to 0.0238 mgm units).[2] The average daily folic acid intake of well-fed adults has been reported to be about 1.4 mgm units per day.[3] Evidently folic acid is unlike other members of the vitamin B complex (thiamine, riboflavin, pantothenic acid, biotin) in that only a trace appears in the urine of man (<1 per cent. of the probable dietary intake).

To test the possibility that the folic acid is excreted in the urine in a complex form without microbiological activity, urine samples were subjected to autoclaving, autoclaving with very dilute acid or alkali, and digestion with takadiastase (an enzyme preparation used to release folic acid from tissue combination[2]). These procedures did not increase the amount of folic acid found in the urine. We have observed, however, that incubation of urine with a fresh rat liver preparation causes the appearance of more folic acid than can be accounted for by the analysis of the constituents of the digestion mixture. In conducting such experiments we have usually employed 10 cc of urine, or of other test materials dissolved in water, to which has been added 10 cc of a 20 per cent. suspension of fresh rat liver (2 parts of liver ground in a Waring blendor with 8 parts of M/10 phosphate buffer, pH 7). In some experiments we have used a weighed sample of liver fragmented in phosphate buffer with a spatula. Takadiastase (0.4 per cent.) is added, but this does not participate in the formation of folic acid by the liver preparation, under the influence of added substances. The mixtures are covered with a thin layer of benzene and allowed to incubate at 37° C. for 18 to 24 hours. After incubation folic acid is determined in the tissue filtrates by microbiological methods.[4]

---

[1] L. D. Wright, J. R. McMahan, V. H. Cheldelin, A. Taylor, E. E. Snell and R. J. Williams, University of Texas Publication, 4137: 38, 1941.

[2] V. H. Cheldelin, M. A. Eppright, E. E. Snell, B. M. Guirard, University of Texas Publication, 4237: 15, 1942.

[3] R. J. Williams, *Jour. Am. Med. Ass.*, 119: 1, 1942.

Using the technics described we have investigated the material present in urine and the conditions requisite to the formation of folic acid by the rat liver preparation. No increase in the folic acid content occurs, over that calculated from the analyses of the constituents, if a heated rat liver preparation is used. The reaction is inhibited by high concentrations of NaCl and by M/500 NaCN and does not occur if liver extracts are used instead of fresh rat liver. The material in urine is stable to autoclaving for 1½ hours in the presence of normal HCl or H_2SO_4, under which circumstances folic acid itself is destroyed. The substance is readily absorbed on fullers' earth[5] at pH 3 and may be eluted with ammoniacal 50 per cent. alcohol. Using such procedures the material in urine has been concentrated approximately 2,000 times. When other natural materials (grass and liver extracts) are autoclaved with acid and then incubated with liver tissue, more folic acid is usually found on assay of the filtrates than can be accounted for by the analyses of the materials tested.

The stability to acid and the adsorption-elution characteristics of the substance in urine suggest that it may be related to uropterin (a urinary pigment),[6] or xanthopterin (the pigment of yellow butterfly wings),[7] which is claimed to be identical with uropterin.[6] When *synthetic xanthopterin*[8] is incubated with liver tissue a significant increase in the folic acid content of the filtrate from the mixture is usually found. This increase may be demonstrated with either *L. casei* or *Strep. lactis*. Before incubation with rat liver xanthopterin is entirely ineffective in replacing folic acid as a growth factor for either organism. Xanthopterin alone, among the pure compounds thus far tested, causes the formation of an increased amount of folic acid when incubated with rat liver. The following substances have been found ineffective: adenine, guanine, xanthine, uracil, cytosine and synthetic leucopterin[8] (the pigment of white butterfly wings[7]).

Preliminary evidence indicates that under certain circumstances the yield of folic acid, obtained by incubating liver with superfiltrol-eluates from acid-autoclaved liver extracts, may be materially increased by the addition to such mixtures of an aqueous extract of an acid ether extract of acid-autoclaved liver. Such an extract contains a considerable amount of acidic organic material, but is, of course, devoid of folic acid. An attempt to identify the substance or substances responsible for the effect of this material is now in progress. It is possible that the yields of folic acid obtained, when the xanthopterin-like material in acid-autoclaved liver extracts is incubated with rat liver, are limited by the supply of substances related to those found in the ether soluble fraction.

DISCUSSION

Our experiments indicate that a substance stable to both heat and normal acid occurs in either free or combined form in urine, grass and liver. It appears likely that in some materials (grass) a considerable portion of this substance is derived from the degradation of folic acid, in other materials (urine and some liver extracts) the amount formed by autoclaving with acid is too large to have been derived from folic acid alone. The substance, when incubated with a preparation of fresh rat liver, causes the formation of folic acid; an effect also produced by synthetic xanthopterin. The substance obtained from urine, grass and liver has not yet been identified; however, the evidence suggests that it is related to xanthopterin.

Mitchell[9] has claimed that xanthopterin occurs in folic acid concentrates, and Totter and Day[10] have reported that xanthopterin, like concentrates of folic acid, promotes growth and cures leucopenia in rats fed succinylsulfathiazole in highly purified rations. Although neither we nor others[11] have been able to confirm this finding with xanthopterin, we believe a possible explanation of the conflicting data may be based on our results. A personal communication from Dr. Day suggests that age or duration of feeding the purified diet might be involved. It is possible that the response obtained from xanthopterin in rats may be limited by the availability of another substance. Such a possibility is suggested by the results we have obtained with material extracted by ether from a liver

---

[4] M. Landy and D. M. Dicken, *Jour. Lab. and Clin. Med.*, 27: 1086, 1942.

[5] Superfiltrol (thiamine grade).

[6] W. Koschara, *Zeit. f. physiol. Chem.*, 240: 127, 1936.

[7] C. Schöpf and E. Becker, *Ann.*, 507: 266, 1933.

[8] The syntheses of xanthopterin and leucopterin were generously carried out by our colleagues, Drs. A. M. Land and J. M. Sprague, according to the methods of R. Purrmann, *Ann.*, 544: 182, 1940 and 546: 98, 1940.

[9] H. K. Mitchell, SCIENCE, 97: 442, 1943.

[10] J. R. Totter and P. L. Day, *Jour. Biol. Chem.*, 147: 257, 1943.

[11] Personal communication from several laboratories.

TABLE 1

THE FOLIC ACID CONTENT OF RAT LIVER AFTER INCUBATION WITH VARIOUS SUPPLEMENTS

Expt. No.	Incubation mixture (Liver plus Supplement)	Folic Acid Content per gram of		Folic Acid formed per gram of liver
		Liver alone	Liver plus Supplement	
		μ gm units*	μ gm units*	μ gm units*
1	Liver (2.0 gm) + Urine (10 cc = 0.08 μ gm units of folic acid)	9.2	17.2	8.0
2	Liver (2.0 gm) + Urine (10 cc = 0.08 μ gm units of folic acid)	16.0	26.0	10.0
3	Liver (4.8 gm) + Urine (20 cc = 0.16 μ gm units of folic acid)	10.0	30.8	20.8
4	Liver (3.0 gm) + Urine (10 cc)	6.8	12.8	6.0
	Liver (3.0 gm) + Urine (10 cc) after treatment with superfiltrol	6.8	8.8	2.0
	Liver (3.6 gm) + Superfiltrol eluate ⇔ 10 cc urine	6.8	12.9	6.1
5	Liver (2.5 gm) + Urine (10 cc = 0.13 μ gm units of folic acid)	10.4	14.4	4.0
	Liver (2.1 gm) + Acid-autoclaved urine (10 cc = 0.00 μ gm units of folic acid)	10.4	23.2	12.8
6	Liver (2.0 gm) + Xanthopterin (250 μ gm)	8.0	14.0	6.0
7	Liver (2.0 gm) + Xanthopterin (250 μ gm)	5.6	17.2	11.6
8	Liver (2.0 gm) + Xanthopterin (250 μ gm)	4.0	10.4	6.4
9	Liver (2.0 gm) + Adenine, guanine, xanthine, uracil or cytosine (250 μ gm)	4.4–4.8	4.4–4.8	0.0
	Liver (2.0 gm) + Xanthopterin (250 μ gm)	4.6	15.2	10.6
10	Liver (2.0 gm) + Leucopterin (250 μ gm)	16.0	14.4	0.0
11	Liver (2.9 gm) + Armour's parenteral liver extract (15 anti-P.A. units per cc) (0.1 cc = 1.4 μ gm units of folic acid)	20.0	26.0	6.0
12	Liver (2.6 gm) + Powdered Liver Concentrate (Wilson's 1 : 20), 200 mgm = 3.0 μ gm units of folic acid per gram of rat liver present	8.4	11.2	2.8
	Liver (3.1 gm) + Acid-autoclaved Powdered Liver Concentrate (Wilson's 1 : 20), 200 mgm = 0.02 μ gm units of folic acid per gram of rat liver present	8.4	36.4	28.0

* Results are expressed in terms of μ gm "potency 40,000 material," as described by V. H. Cheldelin, *et al.* (footnote 2).

extract autoclaved with acid. Such a substance might be stored to some extent in the liver of rats on normal diets, and might be derived from either dietary sources or from bacterial synthesis in the intestine. With continued feeding of purified diets or of purified diets containing succinylsulfathiazole, liver storage would be progressively reduced and the influence of xanthopterin on the synthesis of adequate amounts of folic acid in the liver of the rat would be inhibited.

Xanthopterin has been reported as effective in the cure of goats' milk anemia in rats[12] and as an anti-anemia factor for fish.[13] Evidence has recently been presented which indicates the identity of folic acid with a crystalline chick anti-anemia factor (vitamin B_c),[14] which has enormous activity as a growth factor for *L. casei* in the absence of folic acid concentrates,[14] and which functions similarly for *Strep. lactis*. Concentrates containing folic acid have proved effective in the treatment of leucopenia and anemia in the rat on purified diets containing poorly absorbed sulfonamides,[15, 16] and in the monkey on purified diets alone.[17, 18] In one monkey alleviation of leucopenia and anemia followed the use of xanthopterin when a liver powder prepared by heating fresh liver at 100° C. for 24 hours was also fed. Neither substance was effective by itself.[19]

It appears reasonable to suggest that from xanthopterin or closely related compounds may be derived substances concerned with the formation of erythrocytes and granulocytes. Various animal species appear to vary in the complexity of their requirements for hemocytopoietic material. In man the utilization of dietary anti-anemia material (extrinsic factor) is known to require the participation of an additional substance found in gastric juice (intrinsic factor), for the formation of what appears to be a more complex substance (anti-pernicious anemia factor). Assays of several liver extracts intended for parenteral use in pernicious anemia therapy have shown the presence of small amounts of folic acid, and of larger amounts of the substance(s) formed by autoclaving with acid.

---

[12] R. Tschesche and H. J. Wolf, *Zeit. f. physiol. Chem.*, 248: 34, 1937.

[13] R. W. Simmons and E. R. Norris, *Jour. Biol. Chem.*, 140: 679, 1941.

[14] J. J. Pfiffner, S. B. Binkley, E. S. Bloom, R. A. Brown, O. D. Bird, A. D. Emmett, A. G. Hogan and B. L. O'Dell, SCIENCE, 97: 404, 1943.

[15] S. S. Spicer, F. S. Daft, W. H. Sebrell and L. L. Ashburn, *Pub. Health Rep.*, 57: 1559, 1942.

[16] A. E. Axelrod, P. Gross, M. D. Bosse and K. F. Swingle, *Jour. Biol. Chem.*, 148: 721, 1943.

[17] W. C. Langston, W. J. Darby, C. F. Shukers and P. L. Day, *Jour. Exper. Med.*, 68: 923, 1938.

[18] S. Saslaw, H. E. Wilson, C. A. Doan and J. L. Schwab, SCIENCE, 97: 514, 1943.

[19] J. R. Totter, C. F. Shukers, J. Kolson, V. Mims and P. L. Day, *Fed. Proc.*, 2: 72, 1943.

SUMMARY

The occurrence in urine and in acid-autoclaved grass and liver extracts of a substance which appears to participate in the synthesis of folic acid by rat liver *in vitro* is described. A similar effect is produced by synthetic xanthopterin. The effect of these materials might be accomplished by (1) catalysis of the enzymatic synthesis of folic acid; (2) the release of folic acid not liberated by takadiastase from tissue complexes; or (3) their serving as substrate material for the enzymatic synthesis of folic acid. The data presented favor the last hypothesis and suggest that xanthopterin, or a substance derived from it, may constitute a portion of the folic acid molecule. The probable involvement of compounds related to xanthopterin in the formation of hemocytopoietic substances in several animal species is discussed.[20]

LEMUEL D. WRIGHT
ARNOLD D. WELCH

NUTRITIONAL LABORATORIES,
DEPARTMENT OF PHARMACOLOGY,
MEDICAL-RESEARCH DIVISION,
SHARP AND DOHME, INC.,
GLENOLDEN, PA.

DISTRIBUTION AND HEREDITY OF VARIANTS OF THE RH TYPE[1]

WITH the aid of anti-rhesus immune sera, Landsteiner and Wiener[2] divided human beings into two classes, Rh positive and Rh negative, the former comprising about 84 per cent. of white individuals in New York City. These authors[3] also showed that the Rh factor is inherited as a simple mendelian dominant, independently of the blood groups and M-N types. The Rh factor has proved to be of considerable clinical importance in the etiology of intragroup hemolytic transfusion reactions[4,5] and in the pathogenesis of erythroblastosis fetalis.[6,7,8]

It was early recognized that the Rh factor is antigenically and genetically complex. Thus, Wiener[5] described an anti-Rh serum which agglutinated only about 70 per cent. of all bloods from white individuals, and pointed out that with the aid of this special anti-Rh serum the Rh type can be subdivided into two subtypes analogous to the major subgroups of A. According to the terminology suggested by Wiener and Landsteiner,[9] Rh positive bloods reacting with the special anti-Rh serum (now designated anti-Rh_1) belong to type Rh_1, while the remainder (about one sixth of the Rh positive bloods) belong to type Rh_2. As Wiener and Landsteiner[9] have shown, the types Rh_1, Rh_2 and negative are inherited by means of triple allelic genes Rh_1, Rh_2 and rh, where Rh_1 and Rh_2 are both dominant over rh and and Rh_1 is dominant over Rh_2.

The situation is further complicated by the fact that some bloods of subtype Rh_1 (reacting with anti-Rh_1 serum) do not react with guinea-pig anti-rhesus serum, so that a fourth type is determined in that way.[3] This type (designated as Rh′) is rare, comprising only about 3 per cent. of all white individuals. It should be mentioned that to allow for this special type, it was originally suggested that the standard guinea-pig anti-rhesus (giving about 84 per cent. positive reactions) be designated as anti-Rh_1, and the anti-Rh serum giving 70 per cent. positive reactions as anti-Rh_2.[10] This terminology has been abandoned, however, because it was found that the hypothetical agglutinogens determined in this way do not mendelize like A and B but are apparently "partial antigens" like the factors B_I, B_{II}, B_{III} . . . of human group B blood, and the factors F_A, A_1, A of group A_1 blood.[11] In the present communication, only the major subtypes, Rh_1 and Rh_2, and not type Rh′, will be included in the discussion.

Recently, Wiener and Sonn[12] have described a serum from a mother of an erythroblastotic infant, which contained a potent anti-Rh agglutinin reacting with only about 30 per cent. of bloods of white individuals. The agglutinogen detected by this serum appears to be of clinical importance in relation to the occurrence of hemolytic reactions in certain Rh positive patients and in many cases of erythroblastosis.[13] Wiener and Sonn[12] have shown that the agglutinogen detected by the new anti-Rh serum is inherited as a simple Mendelian dominant, probably by means of a special allelic gene. Therefore, these observations may also have application in forensic medicine, not only by further increasing the identifiable types of human blood but also by substantially increasing the chances of exclusion in cases of disputed parentage. The purpose of the present communication is to present some new data on the distribution of the major variants of the Rh type, which are of significance in relation to the heredity mechanism.

---

[20] We are indebted to Miss Helen Ryan for capable assistance; to Dr. W. R. Graham, of the Cerophyl Laboratories, for generous supplies of grass juice powder; to Dr. David Klein, of the Wilson Laboratories, for the powdered liver concentrate (1 : 20). Some of the data in this paper were presented before the Philadelphia Physiological Society on May 18, 1943; an abstract appears in the *Am. Jour. Med. Sci.*, 206: 128, 1943.

[1] From the Serological Laboratory of the Office of the Chief Medical Examiner of New York City. Aided by a grant from the Carnegie Foundation and the Committee on Human Heredity of the National Research Council.

[2] K. Landsteiner and A. S. Wiener, *Proc. Soc. Exp. Biol. and Med.*, 43: 223, 1940.

[3] K. Landsteiner and A. S. Wiener, *Jour. Exp. Med.*, 74: 309, 1941.

[4] A. S. Wiener and H. R. Peters, *Ann. Int. Med.*, 13: 2306, 1940.

[5] A. S. Wiener, *Arch. Path.*, 32: 227, 1941.

[6] P. Levine, E. M. Katzin and L. Burnham, *Jour. Am. Med. Assoc.*, 116: 825, 1941.

[7] P. Levine, L. Burnham, E. M. Katzin and P. Vogel, *Am. Jour. Obstet. and Gynec.*, 42: 925, 1941.

[8] L. Burnham, *Am. Jour. Obstet. and Gynec.*, 42: 389, 1941.

[9] A. S. Wiener and K. Landsteiner, *Proc. Soc. Exp. Biol. and Med.*, 53: 167, 1943.

[10] As was first shown by Levine, and confirmed by Wiener, the most common human anti-Rh sera, now designated anti-Rh′, giving about 87 per cent. positive reactions, contain two agglutinins, one corresponding to the 84 per cent. sera (anti-Rh), the other to the 70 per cent. sera (anti-Rh_1).

[11] A. S. Wiener, "Blood Groups and Transfusion," 3rd edition, p. 254. Springfield, Ill.: C. C Thomas. 1943.

[12] A. S. Wiener and E. B. Sonn, *Jour. Immunol.*, in press.

The Rh reactions of a random series of 280 blood samples from white individuals in New York City are summarized in Table I. It is evident that the new anti-Rh serum makes possible further subdivisions within the major subtypes Rh_1 and Rh_2 and that the incidence of positive reactions is much higher in the latter type. For this and other reasons (see below), *it is proposed tentatively to designate* the new agglutinin as anti-Rh_2 and the agglutinogen detected by it as Rh_2. Thus, type Rh_1 is now subdivided into type Rh_1Rh_2 (positive with anti-Rh_2 serum) and type Rh_1 proper (negative with anti-Rh_2 serum), while type Rh_2 is subdivided into type Rh_2 proper (positive with anti-Rh_2 serum) and Rh (negative with anti-Rh_2 serum). In the so-called Rh-negative type, there are rare bloods agglutinated by the anti-Rh_2 serum (see Table I). It is obvious that such individuals should now be deleted from the Rh negative type, because the use of their blood for patients actively or passively sensitized to the Rh_2 agglutinogen might prove dangerous.

TABLE I

DISTRIBUTION OF THE SUBTYPES OF RH

Type*	Rh_1		Rh_2		Negative		
Reaction with special anti-Rh serum	Pos.	Neg.	Pos.	Neg.	Pos.	Neg.	Total
Number	49	141	35	16	1	38	280
Per cent.	17.5	50.3	12.5	5.8	0.3	13.6	100.0
Number in major types	190		51		39		280
Per cent.	67.8		18.3		13.9		100.0

* Determined with the aid of human anti-Rh′ and anti-Rh_1 sera.

The hypothesis that the agglutinogen detected by the anti-Rh_2 serum is determined by a gene allelic to *rh* can be tested as follows:

If we disregard the reactions of the anti-Rh_2 serum, the distribution of the major subtypes in our series is as follows:

$$\text{Type } Rh_1 = 67.8 \text{ per cent.} \qquad (1)$$
$$\text{Type } Rh_2 = 18.3 \text{ per cent.} \qquad (2)$$
$$\text{Rh negative} = 13.9 \text{ per cent.} \qquad (3)$$

and the frequencies of the three corresponding genes are calculated in the usual manner:[14]

$$rh = \sqrt{\text{Neg.}} = \sqrt{0.139} = 37.3 \text{ per cent.} \qquad (4)$$
$$\boldsymbol{Rh_2} = \sqrt{\text{Neg.} + \text{Rh}_2} - \sqrt{\text{Neg.}} = 19.5 \text{ per cent.} \qquad (5)$$
$$\boldsymbol{Rh_1} = 1 - (rh + \boldsymbol{Rh_2}) = 43.2 \text{ per cent.} \qquad (6)$$

If, on the other hand, we only take into account the reactions of the anti-Rh_1 and anti-Rh_2 sera and disregard the anti-Rh′ serum, four types are distinguished as follows:

$$\text{Type } Rh_1Rh_2 = 17.5 \text{ per cent.} \qquad (7)$$
$$\text{Type } Rh_1 = 50.3 \text{ per cent.} \qquad (8)$$
$$\text{Type } Rh_2 = 12.8 \text{ per cent.} \qquad (9)$$
$$\text{Negative} = 19.4 \text{ per cent.} \qquad (10)$$

The possibility that the agglutinogens detected by the anti-Rh_1 and anti-Rh_2 sera are independent of each other is immediately excluded because $Rh_1 \times Rh_2$ is almost twice as great as $\text{Neg.} \times Rh_1Rh_2$. On the other hand, the hypothesis that the agglutinogens detected by the sera anti-Rh_1 and anti-Rh_2 are determined by corresponding allelic genes $\boldsymbol{Rh_1}$ and $\boldsymbol{Rh_2}$ can be tested by calculating the frequencies of the hypothetical genes from the distribution of the four classes above and determining whether the sum of the frequencies equals unity (or 100 per cent.):[15]

$$rh^{16} = \sqrt{\text{Neg.}} = \sqrt{0.194} = 44.5 \text{ per cent.} \qquad (11)$$
$$\boldsymbol{Rh_1} = \sqrt{\text{Neg.} + \text{Rh}_1} - \sqrt{\text{Neg.}} = 39.0 \text{ per cent.} \qquad (12)$$
$$\boldsymbol{Rh_2} = \sqrt{\text{Neg.} + \text{Rh}_2} - \sqrt{\text{Neg.}} = 12.0 \text{ per cent.} \qquad (13)$$
$$rh + \boldsymbol{Rh_1} + \boldsymbol{Rh_2} = 95.5 \text{ per cent.} \qquad (14)$$

The agreement between the calculated and expected results is not entirely satisfactory, but this may be due in part to the relatively small size of the series, and perhaps more probably to difficulties with the technique of these delicate tests. The expected frequency of type Rh_1Rh_2 equals $2 \times Rh_1 \times Rh_2$ or 9.4 per cent.; *i.e.*, much less than the observed frequency. This suggests that the *problem be further investigated*, concentrating particularly on bloods of this type. Of course, additional family studies will also aid in the solution of the problem.

In conclusion, it may be mentioned that the existence of variants of Rh serves to explain the puzzling observations on the differences in specificity of human anti-Rh sera. Thus, it is now possible to anticipate the behavior of a post-transfusion anti-Rh serum if the Rh subtype of the donor is known, while the quality of the anti-Rh agglutinins in sera from mothers of erythroblastotic babies may be predicted by tests on the blood of the husband or infant.[17] On the other hand, the uniformity in specificity of the guinea-pig antisera is most likely due to the corresponding uniformity of the Rh-like antigens in the red cells of different rhesus monkeys.

---

[13] A. S. Wiener, *Amer. Jour. Clin. Path.*, in press.

[14] *Cf.* A. S. Wiener, "Blood Groups and Transfusion," p. 215, 1943.

[15] *Cf.* A. S. Wiener, "Blood Groups and Transfusion," p. 186, 1943.

[16] This value is greater than that given in (4) because some Rh_2 bloods are now included in the "negative" class. For the same reason, the value given by (13) is less than that given by (5).

Alexander S. Wiener

Brooklyn, N. Y.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE DEMONSTRATION OF THE PROTOZOAN PARASITE OF QUAIL MALARIA BY FLUORESCENCE MICROSCOPY

The favorable results which have been obtained in development of diagnostic methods for detecting acid-fast bacteria by fluorescence[1] (Hagemann and others) and the results obtained by Bock and Oesterlin[2] in their studies of the action of anti-malarial drugs have suggested the potential value of this method for the diagnosis of malarial infections from blood smears. Subsequent work by the authors has demonstrated that the human parasite, *Plasmodium vivax*,[3] and the organisms of bird malaria, *P. nucleophilum*,[4] and *Haemoproteus* sp.[5] (from California Valley quail) can be stained in a satisfactory manner with fluorescent dyes.

Due to the large size of the parasite and the supply of the *Haemoproteus*, the bulk of the work in these laboratories has been done with this organism.

During the course of investigation positive staining reactions were observed with six fluorochromes. These were applied from saturated aqueous solutions to smears fixed in methyl alcohol as for Giemsa staining. The staining time is from two to five minutes. Alcoholic solutions can be substituted if the smears tend to wash off the slides with the aqueous stain. The six stains and their effectiveness in differentiating *Haemoproteus* are listed in Table 1.

TABLE 1

Stain	Nuclear color	Parasite color	Leucocyte color	Staining intensity
Beberine sulfate	Bright yellow	Golden	Yellow	+++
*Rivanol	Yellow green	Yellow green	Bright yellow	+++
Primulin yellow	Blue	Blue white	Yellow	+++
Coriphosphine 0	Orange	Orange	Bright orange	++
Thioflavin	Yellow	Yellow	Yellow	++
Auramine 0	Yellow	Blue-white	Bright yellow	+

* 2-Ethoxy-6, 9-diamino acridine lactate.

Altering the pH of the staining medium with phosphate buffers showed a very slight increase in staining intensity in the alkaline region.

The apparatus necessary for fluorescence investigations of this nature is relatively simple. The principal innovation in equipment from ordinary microscopy is the use of a G.E. type H-4 high pressure mercury vapor lamp as the light source and a Corning filter No. 5840 which transmits the light between wavelengths of 310 mμ to 394 mμ. Ultraviolet light in this region is invisible but excites fluorescence in the fluorochromes.

The advantages of this technique if developed for the diagnosis of human malaria are many. The staining process is short, simple and reliable; the parasites, if present, stand out brilliantly as brightly fluorescent objects against a dark field; *Haemoproteus* of bird malaria and the *Plasmodia* of human malaria are readily discernible with dry lenses at magnifications not in excess of 200 ×; and the factor of eyestrain is greatly reduced.

Circumstances do not permit the full development of these techniques as applied to malarial diagnosis in this laboratory. All the results thus far obtained indicate that the method offers great possibilities in enhancing both the speed and accuracy of malarial diagnosis from blood smears. It also offers an interesting technique for the study of anti-malarial drugs (many of which are fluorescent) and their action upon the parasites.

Robert L. Patton
Robert L. Metcalf[6]

Cornell University

---

[17] A. S. Wiener, *Amer. Jour. Clin. Path.*, in press.

[1] P. K. H. Hagemann, *Munch. Med. Wschr.*, 85: 1066, 1938.

[2] E. Bock and M. Oesterlin, *Zbl. Bakt.*, 143: 306, 1939.

[3] Furnished by Dr. Martin D. Young and Dr. Mark F. Boyd, U. S. Public Health Service and Rockefeller Foundation, respectively.

[4] Furnished by Dr. R. D. Manwell, Syracuse University.

[5] Furnished by Dr. C. M. Herman, Division of Fish and Game, State of California.

[6] Now with the Tennessee Valley Authority, Wilson Dam, Alabama.

BOOKS RECEIVED

Bills, Arthur Gilbert. *The Psychology of Efficiency.* Illustrated. Pp. xiv + 361. Harper & Brothers. $2.75.

Shapiro, Harry. *Applied Anatomy of the Head and Neck.* Illustrated. Pp. xiv + 189. J. B. Lippincott Co. $5.50.

Thompson, W. H. and M. L. Aiken. *1000 Preflight Problems.* Illustrated. Pp. xiv + 160. Harper and Brothers. $0.88, paper-bound; $1.20, cloth-bound.

SCIENCE

VOL. 98 FRIDAY, AUGUST 27, 1943 No. 2539

The Wildlife Society: DR. WALTER P. TAYLOR ... 185

Vitamins in Edible Soybeans: DR. PAUL R. BURKHOLDER ... 188

Obituary:
Hamilton Perkins Cady: DR. RAY Q. BREWSTER. *Harold Norris Ets:* DR. H. A. MCGUIGAN. *Recent Deaths* ... 190

Scientific Events:
The Birth and Death Rates in Great Britain; Rare Chemicals; Penicillin; Aircraft Engineering; A Post-graduate Course in Industrial Medicine; The American Foundation for Tropical Medicine ... 192

Scientific Notes and News ... 194

Discussion:
Arbitrary Editorial Changes in Scientific Papers: PROFESSOR WILLIAM C. BOYD. *Geology Texts for Latin America:* HOBART E. STOCKING. *Colored Transparencies of Tropical Plants:* CAPTAIN ELMER W. ELLSWORTH. *Crown-gall Bacteria:* DR. PHILIP R. WHITE ... 197

Scientific Books:
Organic Chemistry: PROFESSOR MARSTON T. BOGERT. *The Moths of South Africa:* PROFESSOR T. D. A. COCKERELL ... 199

Special Articles:
On the Type of Cholinesterase Present in Brain Tissue: DR. BRUNO MENDEL and HARRY RUDNEY. *Entrance of Chloride with Potassium into Live Rat Muscle Fibers:* DR. WALTER S. WILDE. *Pigment Production by Tubercle Bacillus in the Presence of P-Aminobenzoic Acid:* DR. RUDOLF L. MAYER ... 201

Scientific Apparatus and Laboratory Methods:
Glyoxal in Histological Fixations: L. F. WICKS and DR. V. SUNTZEFF ... 204

Science News ... 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE WILDLIFE SOCIETY

By Dr. WALTER P. TAYLOR

PRESIDENT OF THE WILDLIFE SOCIETY

WHILE a strong federation of biologists, as suggested by Griggs,[1] is highly desirable, it may be a long time coming. In the meantime, biologists generally might well support with ever-increased vigor such unifying enterprises as the Division of Biology and Agriculture of the National Research Council, the Roster of Scientific and Specialized Personnel and the Union of American Biological Societies (and through it, *Biological Abstracts*). Then, too, the various special organizations should cooperate to the fullest extent with each other and the scientific public so that the science as a whole may be steadily advanced.

In this connection the work of some of these societies is none too well known to the scientific public, this being particularly true of those most recently organized. Perhaps it will help if the various groups know each other better.

One of the active societies set up within the last few years is the Wildlife Society, organized in Washington, D. C., in February, 1936, to foster specifically the interests of wildlife specialists. Since that date the organization has steadily expanded until in 1942 there were two honorary, 309 active and 454 associate members.

As stated in its constitution, the principal objectives of the society are (1) establishment of professional solidarity and the maintenance of the highest possible professional standards; (2) development of all types of wildlife management along sound biological lines; (3) publications to effect these ends, and (4) protection of the interests of its members.

In pursuance of the first and fourth objectives the society has maintained a Committee on Professional Standards which has worked on such problems as proper qualifications for active membership, wildlife curricula in the schools and civil service status of wildlife workers. No move has been made as yet to appraise and approve the schools which give wildlife training. In relation to the second objective, through vigorous efforts in research, restoration and administration, attempts have been made to advance the adequacy of wildlife services to the states and the nation as a whole.

---

[1] SCIENCE, 96: 2503, 546–551, December 18, 1942.

The *Journal of Wildlife Management*, for six years under the editorship of W. L. McAtee, now under Dr. Tracy I. Storer, has already made a secure place for itself by the high standard of its contents, being, in part, a discharge of the society's responsibility for published results.

In view of the relative novelty of the term "wildlife" (formerly written as two words, now as one), the exact scope of the society's work at times has not been any too clear.

Rodington and Higgins point out[2] that in its broadest sense wildlife would include every living organism in a state of nature. As covered by them, however, wildlife conservation embraced largely the vertebrate wild animals, chiefly the fishes, birds and mammals, with incidental mention of the amphibians, reptiles and shellfish. These authors further point out that when the lower forms, including fishes, are not specifically named, wildlife is considered to comprise chiefly birds (game, non-game and insectivorous) and mammals (game, fur-bearing and others) measures for the conservation of which are state-wide, national and international. Shelford's definition[3] regards wildlife as including ". . . all uncultivated plants and undomesticated animals native to our continent. . . ."

While a principal emphasis of the society is quite properly on game and game fish, its interests are by no means exclusive—indeed, if the wildlife specialist is to take proper care of fish and game interests he must, of course, be ecologically minded and must give some attention to all factors of environment which affect these things. Seemingly the founders had this in mind; at least they did not restrict the work of the society to game, apparently thinking of wildlife in a broad sense.

It may be helpful to explore briefly some of the possibly important cooperative relationships (in addition to fish and game conservation work) through which the work of the wildlife specialists impinges upon or is related to the activities of their biological colleagues.

EDUCATION

Emphasis upon more thoroughgoing and adequate *conservation education* looking toward the perpetuation of our basic natural resources (including soils, waters, range forage, forests, fisheries, wildlife and human life) has been marked at recent conventions of the Wildlife Society. Already teachers in the fields of natural history and wildlife management make up a prominent section of the membership. These members are working hard on a more effective public education in reference to the maintenance of those material elements which are so necessary in prosecuting a successful war or in a rehabilitation program following its conclusion.

PUBLIC HEALTH AND SANITATION

A threatening phase of the *public health* situation at the present time is that of bubonic (or pneumonic) plague on the Pacific Coast and in some of the other western states. Typhus fever in the South is also important. These are intimately associated with problems of wild animal life, particularly the brown rat, secondarily, in certain instances, with native rodent populations. The diseases transmissible from wild animals to man are many and numerous, some of them serious. The technical men of the Wildlife Society through cooperation with the medical sciences and public health groups can make a distinct contribution. Nor should malaria be overlooked. The proposed treatments for mosquito control by those with an engineering type of mind affect to such an extent the wildlife resources (including not only fishes and aquatic organisms of many sorts, and ducks and waterfowl, but human welfare as well) that this phase of the public health and sanitation program should not be neglected.

LAND USE AND LAND HEALTH

In many states, from the beginning of the recent "land use planning" movement, members of the Wildlife Society, in cooperation with extension services, the Bureau of Agricultural Economics and other public and private groups and individuals, have participated actively in assisting to work out improved plans for *land management*. This is as it should be. Land use and land health are so intimately related to undomesticated plants and animals, including the protozoa, bacteria, burrowing worms, insects, rodents and the other forms of life, animal and vegetable, within and above the surface of the soil that there is no possibility or desirability of disentanglement. The wildlife specialists have a large and important contribution to make, all in their proper sphere, to the cause of land use and land health.

BIOLOGICAL INTERRELATIONSHIPS

There is often too much of a tendency to specialize or compartmentalize. In reality there are no hard-

---

[2] In Van Hise and Havemeyer's "Conservation of Our Natural Resources" (Macmillan, 1931, p. 393).

[3] In Parkins and Whitaker's "Our Natural Resources and Their Conservation" (Wiley, 1936, p. 486).

and-fast boundary lines in nature, which is, after all, a single vast system of material and energy. A part of the universal energy circulates at any given moment through our domesticated species of birds, animals and plants, including ourselves. At the same time another part of it pulses through the natural undomesticated species, including all the groups of wild organisms (both plants and animals) which inhabit the earth. The wildlife specialist, who is at heart an ecologist, has some responsibility to assist in the interpretation and application of these principles, which have to do with so many phases of life and living and the basic materials which make existence possible.

CAMOUFLAGE

Military requirements have emphasized the need for effective camouflage. While it is true that representatives of architects, engineers or landscape artists have to a large extent monopolized this field, nevertheless the basic information comes from nature's own devices to conceal activities and operations of animals from their enemies or their prey. Wildlife specialists should be of increasing service to the armed forces and to educational institutions by cooperating aggressively with those who are working out problems in this field.

CONTROL—NATURAL, APPLIED AND CLIMATIC

As one of the most practical of all applications of biological theory, much of the *control* of *organisms* (especially of vertebrates) comes under the ken, interest and work of members of the Wildlife Society. The need is plainly apparent for improved discrimination in planning for control measures and for less wasteful application. While biological control has been utilized in an important way in economic entomology, its possibilities in other fields are only just now being given attention. The rapid and efficient transportation of men and materials over great distances threatens a spread of malaria, yellow fever and some of the other ailments from which, up to the present, remoteness has afforded protection. Already more than 50 biologists have been assigned to the Sanitary Corps of the United States Army.

CONSERVATION

As pointed out by many leading members of this society, the "conservation" in which its members are interested is not alone the protection of some particular game or fish species but proper care for all nature. The interests of man can not be served effectively unless the conservation enterprise addresses itself to all the basic production resources (including minerals, soils, waters, forage on the grazing range, forests, fisheries, wildlife, human life), indeed all those things that go to make up the resources for food, shelter, recreation and human vitality, which are essential for the survival of mankind.

RECREATION

England early found that her workers could not produce at the highest rate if they became over-tired. Needed is maximum production of all sorts of war materials (including food), not maximum exhaustion of all the workers. Emphasis upon outdoors living, camping, photographing, hiking, hunting and fishing in the intervals between work is important in wartime as well as in time of peace, for relaxation, rehabilitation and the building of morale.

COURSES ON OUTDOOR LIVING

Millions of American boys are now going to the ends of the earth, and many will be more or less dependent on living on the land. The success of camp life depends to a great degree on the extent to which individuals and groups can cooperate with nature, adapt themselves to unfamiliar environments, and win through to security. Fortunately courses in outdoor living are growing in number. The University of Michigan, Cornell University, Syracuse University, Iowa State College, the University of Missouri and several others are already giving these courses, which help to answer such questions as: How proceed when lost in an unfamiliar country? What is available for food? How about poisonous vegetation and animal life? How assure the maximum comfort and efficiency in living under unfamiliar conditions? How protect oneself against pests and diseases?

PRODUCTION OF FOOD AND SHELTER

The problems of food, clothing and shelter have recently received an increasing amount of attention. A new importance is attached to the hides of fur animals, the down from certain waterfowl, the skins of deer, elk and many other wild animals. Many of the materials derivable from the wild natural animal and plant kingdom are well known to the wildlife specialist, who is sometimes in a favorable position to be helpful to civilian and military establishments.

It has been emphasized that as sources of protein requirements of our people, the fishes of the sea are exceeded in value and importance only by pork and beef. Perhaps shark livers as sources of vitamins have received undue attention, but the millions of pounds of marine resources which may now be developed if the pinch becomes severe enough and if a program can be properly balanced have been little attended to or appreciated.

An immense amount of research and other work needs to be done in discovering, developing and using the expanding resources from "ocean pastures."

"Wildlife" should certainly be thought of as including marine and fresh-water fisheries as well as the terrestrial vertebrates; but some do not so understand it. In any case, the leadership of the brilliant group of technical and administrative men who have accomplished so much in the field of the commercial fisheries is appreciated. They deserve much credit from the public. The Fisheries Coordination Office, in placing a large number of trained men in the field and in Washington, dealing directly with the commercial production of fish and fish products, is entitled to the utmost support and cooperation.

Even the fresh-water ponds which are so conspicuous a feature of the work of some of the state conservation departments, extension services, the Soil Conservation Service and Agricultural Adjustment Agency activities in many parts of the United States are not to be depreciated. The figures are large as to potential production of a supplemental food supply from these farm ponds. Whether or not actual advance is made along these lines depends to a considerable extent upon the activities and leadership of technical men who are interested in inland fisheries and upon the provision of funds with which they can work. Their success in this field, supported by an intelligent government and an enlightened public opinion, may mean an appreciable contribution to the nation's food.

MILITARY NATURAL HISTORY

E. L. Palmer and others have emphasized the place of the military naturalist at this particular period—the man who knows something about the birds, mammals, reptiles, amphibians, fishes, worms and insects, as well as the plants of the numerous war fronts on which United Nations' soldiers are fighting. Some of the wildlife specialists are unusually well qualified to assist the Army, Navy and other branches in the preparation of manuals, instructions and directions for protection from inimical plants and animals and utilization of those which can be put to use.

In this connection it is of interest that nature is not unfriendly to those who know something about her. Even the arctic environment was pleasurable and livable to Stefansson. The terrible winter climate of continental Europe was friendly to the Russians, who understood it and used it, but inimical to the Germans, who did not understand it so well. The Japanese, by adapting themselves to their environment, were able to survive and conquer in the Malayan Peninsula. The war work of biologists is already extensive. The Special Services Branches of Army and Navy, the Desert, Arctic and Tropical Services of the Army Air Corps, the Sanitary Corps of the Army, the Quartermaster Corps, the Signal Corps, the Naval Research Laboratories and many others are using biologically trained men. But the work done and human resources in use are only a beginning.

POST-WAR ADJUSTMENTS

Truly, among the wildlife and conservation problems which will arise after the war will be many dealing with fish and game, but others also will require attention and specialized information. Wildlife specialists should cooperate in the outlining of post-war plans. Among these are included collaboration, through appropriate governmental departments and otherwise, in the authorship and administration of treaties for the protection and proper management of international wildlife and fisheries resources, including the products of the sea (whales, marine fishes, fur seals, etc.), wild birds and mammals.

In these considerations there is no thought of encroachment by this society on the work of others but rather the need for expansion of our understanding of what is meant by conservation, and for more thoroughgoing cooperation between biologists.

Paraphrasing, in general conservation terms, a recent statement by Shirley,[4] it may be confidently asserted that the basic production resources, including minerals, soils, waters, range forage, forests, fisheries, wildlife and human life, are indispensable, whether in peace or war. Sustained yield management of all the renewable natural resources to meet not only our own needs but those of other countries is one of the essentials for the establishment of an enduring people's peace. This will require some measure of public control (in which local communities as well as higher levels of government should participate), technical skill and recognition of the economic and ecological interdependence of the nations of the world. An immense field of service lies before conservation specialists, including wildlife workers and many others, who will be available and trained for leadership in organizing and manning the division of natural resources of a great world economic federation.

VITAMINS IN EDIBLE SOYBEANS

By Dr. PAUL R. BURKHOLDER

YALE UNIVERSITY

PRESENT world events forebode a general scarcity sooner or later of foods of animal origin, such as milk, cheese, eggs and meat, which are important in our diet because of their proteins and vitamins. In the future it may become necessary for us to rely more and more upon plant foods as substitutes for animal proteins. The cereals and legumes lend themselves in this role because they possess a high protein content and can be made to yield large crops within a single year.

---

[4] *Journal of Forestry*, 41: 83, February, 1943.

Cereals, such as wheat, are already supplying a significant amount of protein in our diet. Among the legumes, soybeans constitute a rich source of proteins which by chemical analysis have been shown to contain in near optimum proportions the amino acids essential for the nutrition of animals and man. The excellence of soybean flour has been demonstrated recently in extensive feeding experiments with animals.[1] It has been known for a long time that cooking greatly improves the nutritional value of leguminous protein, and recent researches on soybeans amply confirm this fact.[2] Although soybeans and the numerous food products which can be made from them are eminently desirable from the nutritional view-point, their use as food thus far in America and Europe has been limited almost entirely to specialty items. That millions of Chinese have lived on a diet of rice and soybeans for thousands of years constitutes a great natural experiment from which much can be learned. In the future when large quantities of edible soybeans become available, and when food producers and the general public are educated to appreciate the qualities of desirable kinds of *Soja*, the various products made from them may play a more prominent role in the food supplies of Occidental peoples as they have for centuries past in the diets of Orientals.

TABLE 1

VITAMINS IN EDIBLE VARIETIES OF SOYBEANS. DATA FOR B VITAMINS ARE GIVEN AS MICROGRAMS PER GRAM OF DRY MATTER. ASCORBIC ACID IS EXPRESSED AS MILLIGRAMS PER GRAM OF GREEN RAW BEANS

Variety	Thiamine		Riboflavin		Pyridoxine		Biotin		Niacin		Pantothen		Ascorbic acid
	G*	M†	G	M	G	M	G	M	G	M	G	M	G
Aoda	5.6	9.6	4.1	2.3	2.9	6.3	0.66	0.63	46	20	11	11	0.24
Bansei	6.6	8.4	3.5	2.4	3.3	6.2	0.42	0.62	44	23	12	12	0.21
Giant Green	7.6	8.5	3.6	2.1	4.2	7.4	0.52	0.69	26	19	11	14	. . .
Hokkaido	6.6	9.5	3.0	2.3	3.2	6.6	0.54	0.51	37	20	12	11	0.18
Toku	5.6	9.0	3.1	2.1	3.5	5.4	0.66	0.72	40	19	12	12	0.19
Willomi	6.2	9.2	4.5	2.4	3.9	6.3	0.43	0.49	48	20	13	12	0.23
Means for six varieties	6.4	9.0	3.5	2.3	3.5	6.4	0.54	0.61	40	20	12	12	0.21

* G = Green or immature.
† M = Mature.

It is now recognized that soybeans possess desirable qualities not alone by their contribution of amino acids for nourishing the body, but also through their stores of fatty materials and accessory growth factors —the vitamins. In studies on the choline content of many kinds of animal and plant products, Engel[3] found that soybeans rank higher than leafy vegetables, root crops or cereal grains in this important methyl compound. Hafner[4] has recently reported favorably upon the vitamin B complex and protein in soybean flour. Although several studies[5, 6, 7] have provided isolated bits of information about the vitamin content of soybeans, the subject has received less attention than it deserves.

The present paper constitutes a brief report on the analyses obtained for seven vitamins in six varieties of edible soybeans harvested as fresh green beans and also as dry mature beans. The soybeans supplied through the kindness of the grower, Everett Clark, of the Associated Seed Growers, Milford, Conn., were harvested in the autumn of 1942. Tests for ascorbic acid were made promptly on materials ground in metaphosphoric acid. Samples of the green beans were dried rapidly at 70° C. The dehydrated fresh material and mature seeds were stored in the laboratory until assays for the B vitamins were performed in April, 1943.

Both the green and the mature beans were ground in a small Wiley mill to facilitate extraction of the water-soluble vitamins. For the purpose of obtaining extracts, 0.5 gm of the ground material was placed in 30 ml of buffer solution at pH 4.5. The buffer solution contained 3.75 gm glacial acetic acid and 5.0 gm anhydrous sodium acetate per liter. Twenty milligrams of papain and 20 mg of Takadiastase were added to each half gram sample, and the mixture was incubated at 37° C. for 24 hours. A few drops of benzene were used to inhibit growth of microorganisms. The digested material was heated in steam at 100° C. for 30 minutes, made up to a volume of 50 ml, filtered with supercel in a Büchner funnel and subsequently extracted with ether to remove fatty substances which might have interfered with the microbiological assays. A separate series of analyses, in which the ether extraction was omitted, yielded a similar set of results. Pyridoxine was assayed with a yeast growth method.[8] Riboflavin, biotin, niacin and pantothenic acid were tested in accordance with methods published by R. J. Williams *et al.*[9] Thiamine was determined by the yeast fermentation method.[10] Ascorbic acid was measured by the technique of Evelyn *et al.*[11]

---

[1] D. Breese Jones and J. P. Divine, *Soybean Digest*, September, 1942.

[2] J. W. Hayward and F. H. Hafner, *Poultry Sci.*, 20: 139, 1941.

[3] R. W. Engel, *Jour. Nutr.*, 25: 441, 1943.

[4] F. Hafner, *Bakers Digest*, 16: 247, 1942.

[5] Lela E. Booher *et al.*, U.S.D.A. Circular No. 638, 1942.

[6] J. O. Lampen *et al.*, *Jour. Nutr.*, 23: 11, 1942.

[7] R. W. McVicar and G. H. Berryman, *Jour. Nutr.*, 24: 235, 1942.

TABLE 2

Comparison of Vitamins in Meat,[12] Wheat and Mature Soybeans. Data are Expressed as μgm Per Gram of Dry Matter

Food	Thiamine	Riboflavin	Pyridoxine	Biotin	Niacin	Pantothen
Beef round	2.1	7.5	2.6	.08	100	17.0
Pork ham	19.0	4.8	0.4	.12	63	6.5
Tenmarq wheat	7.0	1.3	2.0	.17	62	7.6
Soybean (average) ..	9.0	2.3	6.4	.61	20	12.0

[12] Data on meat taken from V. H. Cheldelin and R. J. Williams, Univ. Texas Publ. No. 4237, 105, 1942.

A summary of the averaged data obtained in two separate sets of determinations is shown in Table 1. It is apparent that both immature and mature beans of all the varieties tested contain appreciable stores of B vitamins. Comparison of the averaged data for green and mature beans of the six varieties shows with maturation an increase in thiamine and pyridoxine and a decrease in nicotinic acid. Data are presented in Table 2 for the purpose of indicating the comparative vitamin values of meat, whole wheat and mature soybeans. The vitamin values of soybeans compare favorably with wheat and with meats except that riboflavin and nicotinic acid in the beans are lower than in meat. It should be noted, however, that the niacin in immature *Soja* occurs in double the concentration found in the mature beans.

Although it is beyond the scope of this brief account to deal adequately with the evaluation of various plant materials as substitutes for foods of animal origin, it is hoped that the data offered herewith may be of aid in solving some new food problems.[13]

Paul R. Burkholder

Osborn Botanical Laboratory,
Yale University

OBITUARY

HAMILTON PERKINS CADY

1874–1943

Professor Hamilton Perkins Cady, a member of the chemistry faculty at the University of Kansas for forty-four years and chairman of the department for more than twenty years, died at his home in Lawrence, Kans., on May 26. His many years of research and teaching brought great credit to the university and much satisfaction to himself.

Dr. Cady was born on May 2, 1874, near Council Grove, Kans., but his family moved further east and his secondary education was secured at the Oberlin, Ohio, high school and the Carleton College Academy at Northfield, Minn. Early in his youth Dr. Cady became greatly interested in the subject of chemistry and made many inorganic and organic preparations in his home laboratory. Since he was unable to buy an analytical balance, he made one which was accurate to less than a milligram and made numerous quantitative analyses by its use.

Upon entering the University of Kansas as a freshman in 1894 young Cady soon became impressed with the similarity of water and ammonia. He read everything available upon this subject, and, during his senior year, laid his collection of information before E. C. Franklin—then associate professor of chemistry at the University of Kansas—with the suggestion that liquid ammonia might reasonably be expected to be an ionizing solvent. Franklin was highly enthusiastic over the idea and persuaded Professor Bailey, chairman of the department, to order a cylinder of liquid ammonia. In preparation for this investigation, Franklin and Cady constructed some vacuum-jacketed test-tubes, for such vessels were not on the market in those days. Franklin had previously agreed to go to Central America for a gold-mining company and departed before the ammonia arrived; so Cady was left to do the experiments alone. His joy was almost unbounded when he found that, although ammonia itself had a high resistance, the addition of a few crystals of potassium iodide produced a highly conducting solution. Thus, this young man who had been fearful that all chemical knowledge would be gained before he could have a part in its discovery had, as an undergraduate student, found something which the world did not know and had given chemists a second ionizing solvent.

After obtaining the bachelor's degree at Kansas in

---

[8] P. R. Burkholder, *Am. Jour. Bot.*, 30: 206, 1943.

[9] R. J. Williams, Univ. Texas Publ. No. 4237, 7, 1942.

[10] A. S. Schultz *et al.*, *Ind. Eng. Chem. Anal. Ed.*, 14: 35, 1942.

[11] K. A. Evelyn *et al.*, *Jour. Biol. Chem.*, 126: 645, 1938.

[13] Grateful acknowledgment is made to the Nutrition Foundation for financial assistance.

1897, Cady received a fellowship at Cornell and spent the next two years studying under the direction of Professor W. D. Bancroft. The ammonia work was laid aside, as Bancroft was interested in the phase rule and Dr. Cady later included the latter as one of his "weaknesses." Returning to Kansas as assistant professor in 1899, Cady resumed the work in ammonia and continued to do some research in this field for many years. However, he gradually took up other lines of experimentation, and the ammonia system of compounds was developed by his colleagues, E. C. Franklin and C. A. Kraus.

In 1907, a gas well was drilled near Dexter, Kans., and a local celebration was held in honor of the discovery. However, when an attempt was made to ignite the gas it would not burn. Cady and McFarland analyzed this gas and found that it was mostly nitrogen, but that it also contained 1.84 per cent. helium. Later in analyzing samples of natural gas from the mid-continent field, Dr. Cady showed that many of them contained helium and his work demonstrating the presence of helium in natural gas was of great importance in developing this natural resource.

In the later years of Professor Cady's life, his research was chiefly upon the measurement of the molecular weights of gases, or vaporizable liquids, by means of a special type of Westphal balance. This rapid and highly accurate method is of particular value in determining the purity of organic liquids.

Although Dr. Cady greatly enjoyed research, teaching constituted his real life work. The chief mark of his instruction was his thoroughness. The clear distinction between fact and theory, and the precise statement and understanding of laws and definitions were characteristic of his work in the classroom. Some of his students found such exacting scholarship a great burden, while many thrived upon it, and Dr. Cady considered himself amply repaid for his efforts by the large proportion of his students who have attained eminence in scientific fields.

In personal life, Dr. Cady was a kindly man with an abundance of wit. His amazing store of humorous stories and nonsense verse could be drawn upon to enliven a public address or, more especially, they were used to add sparkle to light conversation with his friends. His death at the age of sixty-nine seems quite untimely. It is to be regretted that another decade was not given to him.

Ray Q. Brewster

HAROLD NORRIS ETS

Harold Norris Ets was born at Rochester, N. Y., on June 10, 1898. His primary education was obtained in the city schools of Rochester, and in 1922, after specializing in chemistry, he received the degree of B.S. from the University of Rochester. From 1920 to 1921 he was chemist with Morris and Company, Chicago. In 1921 he became a member of the department of pharmacology, University of Illinois. He gained the Ph.D. in pharmacology in 1928.

In 1930 he went to Loyola University School of Medicine as assistant professor. From 1940 until his death he held the rank of professor of pharmacology at that institution.

Ets was a productive scholar, well known in the literature. He was highly successful as a teacher and beloved by his students and colleagues. His interest in ethics, in civic and social betterment brought him in contact with the eminent Graham Taylor and other respected social workers in the city of Chicago. His charming personality and active interest in academic and social problems had already gained him a host of friends. A distinguished career was predicted, when he was afflicted with a brain tumor which terminated his work. He died on June 25, 1943. He is survived by his wife, Marie.

H. A. McGuigan

University of Illinois
College of Medicine,
Chicago

RECENT DEATHS

George W. Littlehales died on August 12 at the age of eighty-two years. He was well known during half a century of Federal service for his contributions to the improvement of the means for the navigation of American shipping.

Gustavus A. Anderegg, cable development engineer for the Bell Telephone Laboratories, retired, died on August 15. He was seventy years old.

William Clift, vice-president and secretary of Phipps and Bird, Inc., Richmond, Va., died on July 28. Mr. Clift was a leader in the activities of the Virginia Section of the American Chemical Society and of the Virginia Academy of Science.

Dr. Cecil C. Jones, president and chancellor of the University of New Brunswick, professor of mathematics from 1906 to 1931, died on August 19 at the age of seventy-one years.

Dr. E. P. Stibbe, professor of anatomy at the University of London, died on July 23 at the age of fifty-nine years.

SCIENTIFIC EVENTS

THE BIRTH AND DEATH RATES IN GREAT BRITAIN[1]

More births were registered in England and Wales during the first three months of this year than in any quarter for seventeen years. The total given in the Registrar-General's return for the quarter ended March 31 last was 171,819. This represents a birth-rate of 16.8 per 1,000 of the population—the highest first-quarter rate since 1928.

Total births and birth-rates in England and Wales for the last five March quarters are:

First quarter	Total births	Rate per 1,000 population
1930	153,382	15.0
1940	154,345	15.0
1941	147,027	14.4
1942	158,225	15.5
1943	171,819	16.8

The number of boys born during the three months of this year was 88,815, a proportion of 1,070 boys to 1,000 girls. The average for the 10 preceding first quarters was 1,058 boys to 1,000 girls. There were 5,782 stillbirths, representing 3.3 per cent. of the total births registered.

There was a decline in the number of marriages, and the total of 62,337 was the lowest for any quarter during the year, although it was still well above the pre-war level of first-quarter marriages.

Deaths in England and Wales (including non-civilians) numbered 137,568. The death-rate (based upon the mid-1939 population) was 13.5 per 1,000, compared with 14.8 in the same period of 1942. For the first quarter of the year it was the lowest rate since 1935 and, having regard to the age of the population, represents the highest first-quarter's mortality on record in this country.

The infant mortality rate was 60 per 1,000 live births, or 14 below the average of the 10 preceding first quarters.

Births registered during the quarter exceeded deaths by 34,251. In the corresponding period of last year the excess was 6,963, but in 1940 and 1941 deaths exceeded births by 50,838 and 31,610, respectively.

RARE CHEMICALS

The following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

Paraxanthine (1,7 dimethylxanthine)
Dihydroxyacetone phosphate
3-glyceraldehyde phosphate
Difluoroethanol
Trifluoroethanol
Propylene Glycol Monolaurate
Sorbitol Dilaurate
Potassium Palmolate
Diethyl Ketone (3, Pentanone)
Hexylene, boiling point 68° C
Heptylene, boiling point 98° C
Bulbocapnine
Lactic dehydrogenase crystalline
Straub Flavoprotein
Glucosides of mono- or poly-hydroxyanthraquinones

PENICILLIN

Referring to a note printed in Science (August 6, p. 130), Major General Norman T. Kirk, Surgeon General of the Army, writes that because of limited production supplies of penicillin, the new drug which has proved unusually effective in the treatment of infections which do not respond to other treatment, must be carefully allotted according to the most urgent needs. He said:

> Of the total amount available, which is very small, definite allocations must be made to the Army and Navy, and through the Committee on Medical Research, Office of Scientific Research and Development, to the civilian population.
>
> Like all other promising new developments in medicine, an immediate demand has arisen for wide-spread distribution and use of the drug. However, at the present time it must be carefully used to determine its greatest effectiveness. Then as more becomes available it can be administered with exactness to obtain the greatest use for the largest number of people.

All the penicillin available, which is obtained by extremely careful harvesting of green mold grown under ideal laboratory conditions, is used for the treatment of non-healing wounds and infections resistant to other treatment.

The total amount produced is sufficient to treat only a few hundred cases a week and the Army is allocated less than 50 per cent. of that supply, which is insufficient for its needs.

Production and allocation of the drug is controlled by the War Production Board. The percentage made available for civilian use is distributed by Dr. Chester S. Keefer, of the Evans Memorial Hospital, Boston, Mass., who acts for Dr. A. N. Richards, chairman of the Committee on Medical Research of the Office of Scientific Research and Development. All requests to meet civilian needs are handled by these physicians.

---

[1] *The Times*, London.

AIRCRAFT ENGINEERING

Sir Roy Fedden, addressing the Engineering Industries Association in London on July 22 on his recent extensive tour of North America in connection with aircraft engineering, according to *The Times*, London, said that

> he was impressed by the large numbers of technically trained engineers passing out from American universities. Over 14,000 of them took degrees in engineering in 1942, and over 1,400 in aeronautical engineering.
>
> Many American universities and technical schools were provided with up-to-date and elaborate research equipment, which was subsidized and regularly used by industry, and the training given was highly practical as well as theoretical.
>
> With a few outstanding exceptions, our higher engineering training, though sound technically, was for the most part out of date in outlook, and we had practically no up-to-date laboratories in our universities in the true sense of the word. To improve industrial education, classes should be established to help up-grade foremen and charge hands in special shop practices, as well as in supervision and shop management.
>
> There should be university courses on administration, planning and the production methods of precision machine tools, press work, etc. Such matters require specialized technical training just as much as design. In research there must be an adequate supply of scientifically trained people, capable of initiating and planning the right kind of research, and working out solutions promptly and economically.

To implement his ideas Sir Roy suggested that a council of engineering institutions should be established, containing a suitable admixture of youth and age, and of business and technical men.

A POST-GRADUATE COURSE IN INDUSTRIAL MEDICINE

To meet the continued wartime need for a general training course for physicians engaged in or desiring to enter into industrial practise, the Long Island College of Medicine has announced its second postgraduate course in industrial medicine to be given in Brooklyn during the first two weeks of November. The course is modeled on the first series of lectures and seminars in this field presented in November, 1942, in which fifty-nine matriculants from six states enrolled. Enrolment this year will be limited to fifty matriculants for the full course, which is designed for physicians. A limited number of others will be permitted to attend the sessions as auditors.

The course, which is under the auspices of the Department of Preventive Medicine and Community Health and which is directed by Dr. Thomas D. Dublin, associate professor, will run from November 1 to November 12. It will consist of afternoon and evening lectures at the college and morning clinics in the medical departments of near-by industrial plants. The lectures will be given by leading industrial physicians and members of the faculty.

Additional supervised training in the medical department of selected industrial concerns will be provided for those who desire further practical work. Five matriculants enrolled in 1942 elected to take a month of supervised training, and four were aided by the college in finding industrial positions. Thirty-five of last year's matriculants were physicians, of whom seventeen were in full-time industrial practise.

Assisting Dr. Dublin in the formulation and development of the course are Dr. Cassius H. Watson, medical director of the American Telephone and Telegraph Co., alumnus and trustee of the college; Dr. John J. Wittmer, medical and personnel director of Consolidated Edison Co., an alumnus, and Alfred R. Crawford, of the Department of Administration.

Thirty-seven lecturers will take part in the sessions and a series of clinical and laboratory demonstrations is planned. The general topics of the lecture sessions, various phases of which will be discussed, include "The Physician in Industry and His Field"; "Planning an Industrial Medical Department"; "Evaluating the Health Status of the Worker"; "Occupational and Non-Occupational Incapacitation"; "Community Factors in the Health of the Worker"; "Industrial Accidents"; "Protecting the Place of Work"; "Surgical Management of Industrial Injuries"; "Industrial Toxicology" and "Special Wartime Problems in Industrial Medicine."

The printed announcement with all details and the registration forms will be available by September 15. Physicians desiring further information or wishing to apply should address the Office of Administration, 350 Henry Street, Brooklyn 2, N. Y.

THE AMERICAN FOUNDATION FOR TROPICAL MEDICINE

At a meeting of the Executive Committee of the Board of Trustees of the American Foundation for Tropical Medicine, Inc., in New York City on July 23, according to the report of Dr. Jean A. Curran, executive director, for the six-month period ending June 30, 1943, twelve grants amounting to $43,680 were made.

These grants, made possible by contributions and pledges for the current year of $66,600 by twenty-one American corporations, are being used to strengthen teaching and research programs in tropical medicine and parasitology at the various schools. The approved projects were selected by the medical committee.

Medical schools to receive grants during the period from April 1 to June 30 were: Cornell University Medical College, the School of Medicine of Duke University, the School of Medicine of the University of Pennsylvania and the Medical School of Stanford University. *The Journal of Parasitology* was also aided.

Schools of medicine to which grants were made available during the first quarter of 1943 were: the New York University College of Medicine, the Medical School of Tufts College, the School of Medicine of Tulane University, the Faculty of Medicine of the University of Manitoba, the College of Medicine of the University of Nebraska and the School of Medicine of Yale University.

Companies which have made contributions or formal pledges of support include Abbott Laboratories; American Cyanamid Company; Ciba Pharmaceutical Products Corporation; Firestone Plantations Company; General Foods Corporation; Hoffmann-La Roche, Inc.; The Lambert Company; Lederle Laboratories; Eli Lilly and Company; Merck and Co., Inc.; National Carbon Company; Parke, Davis and Company; E. R. Squibb and Sons; The Texas Company; United Fruit Company; William R. Warner and Company; Winthrop Chemical Company; Winthrop Products, Inc., and John Wyeth and Brother. The foundation also acted as the administrative agency for a special grant from the John and Mary R. Markle Foundation. The executive director stated that other applications are pending, and those recommended for approval will be financed out of contributions. Dr. Curran pointed out that additional gifts would be needed to finance the full program of the foundation for the year 1943.

The program, adopted at the annual meeting of members in January, calls for the collection and disbursement of $100,000 among medical schools and scientific journals and for special projects which fall within its scope.

Officers of the foundation are *President,* Lt. Col. Thomas T. Mackie, director, Division of Parasitology and Tropical Medicine, and executive officer of the course in tropical and military medicine, Army Medical School; *Vice-president,* Dr. Willard C. Rappleye, dean, College of Physicians and Surgeons, Columbia University; *Secretary,* Alfred R. Crawford, assistant to the president, Long Island College of Medicine; *Treasurer,* W. W. Lancaster, partner, Shearman and Sterling; and *Executive Director,* Dr. J. A. Curran, president and dean of the Long Island College of Medicine. Members of the executive committee, in addition to the above officers, are Dr. Theodore G. Klumpp, president of Winthrop Chemical Company, Inc., and Dr. Henry E. Meleney, professor of preventive medicine of the College of Medicine of New York University.

The purposes for which the funds granted during the second quarter of 1943 are being utilized are as follows:

Army Medical Museum. To finance the collection of tropical pathological material and its distribution to American medical colleges.

Cornell University Medical College. Salary aid for full-time instructor in parasitic diseases and to purchase materials for teaching and research.

Duke University School of Medicine. For full-time technician, materials and supplies to establish an identification and distribution center for pathogenic fungi and to maintain a registry of autopsy and biopsy material from cases of fungus disease.

University of Pennsylvania School of Medicine. Salary aid to finance expansion of teaching in parasitology and tropical diseases.

Stanford University Medical School. Salary for full-time technician and funds to purchase supplies and equipment to strengthen teaching of tropical medicine.

Journal of Parasitology. To supplement the publication funds of the *Journal* to permit enlarged type pages.

SCIENTIFIC NOTES AND NEWS

DR. ERNEST CARROLL FAUST, professor of parasitology and acting head of the Department of Tropical Medicine at Tulane University, on August 4 was presented with a diploma of corresponding membership by the Academia Nacional de Medicina of Mexico.

SIR JOHN RUSSELL, director of the Rothamsted Experimental Station, was presented with the Albert Gold Medal of the Royal Society of Arts for 1943 at an informal ceremony on July 26 at the society's house in Adelphi, which was attended by members of the council. The medal was awarded "for his researches and leadership in agricultural science and for his services to husbandry in many lands."

AT the summer commencement on August 13 of Bowling Green State University, Ohio, the honorary degree of doctor of humane letters was conferred on E. L. Moseley, emeritus professor of biology at the university and curator of the university museum.

THE British Institute of Physics has elected the following officers: *President,* Sir Frank Smith; *Vice-presidents,* E. R. Davies, Dr. W. Makower and T. Smith; *Treasurer,* Major C. E. S. Phillips; *Secretary,* Professor J. A. Crowther.

THE *Journal* of the American Medical Association announces the retirement of Dr. Julius W. Sturmer, since 1916 dean at the Philadelphia College of Pharmacy and Science.

DR. LUDWIK ANIGSTEIN, of the department of preventive medicine and public health of the University of Texas, Medical Branch, Galveston, Texas, has been promoted to be associate professor of tropical medicine.

DR. LELAND A. BROWN, dean and head of the department of biology at Transylvania College, Lexington, Ky., has been appointed acting president of the college. He will serve during the absence of Dr. Raymond F. McLain, who has been granted leave to accept a commission as lieutenant in the Naval Reserve.

DR. P. G. NUTTING, of the U. S. Geological Survey, will retire from active duty on August 31. Formerly engaged in work on optics at the Bureau of Standards and later in charge of research work at the Eastman Kodak Company and the Westinghouse Electric Company, he has since 1925 been making physico-chemical studies of clays and the properties of oil-water-silicate combinations.

OF the twenty-five Beit Memorial Research Fellows, sixteen have been seconded for whole-time war work, and at a recent meeting of the trustees the following elections were made, with permission for each fellow to be seconded at any time for war work: *Fourth Year Fellowships:* J. J. D. King, to continue his studies of dental caries and parodontal disease at the nutritional laboratory of the Medical Research Council. P. C. Williams, to continue his studies of natural and synthetic oestrogens at the Courtauld Institute of Biochemistry, Middlesex Hospital, University of London. *Junior Fellowships:* Margery E. M. Cutting, to study the physiological metabolism of organs in infancy at the department of medicine, University of Cambridge. A. Kleczkowski, to study serological reactions in reference to size and shape of antigen and antibody particles at the Rothamsted Experimental Station, Hertfordshire. G. J. Popjak, experimental study of fatty and degenerative changes in the kidney at St. Thomas's Hospital medical school, University of London. Ethel G. Teece, to study the chemical structure of gram-positive and negative microorganisms and to develop antibacterial agents at the department of chemistry, Birmingham University.

DR. RAY B. CREPPS, associate professor of testing materials and director of the materials testing laboratory of Purdue University, will join Owens-Corning Fiberglas Corporation as director of the testing division of the research laboratories at Newark, Ohio.

DR. ROBERT BRUCE MOFFETT, since 1941 post-doctorate research associate at Northwestern University, has been appointed senior research chemist in the laboratories of George A. Breon and Company.

PROFESSOR WILLIAM J. CONLEY, instructor in applied mechanics and acting chairman of the department of engineering of the faculty of the University of Rochester, has resigned to become consulting engineer with the Lincoln Electric Company at Cleveland.

LINCOLN D. KELSEY, professor of extension service at Cornell University, left on August 17 to join the Agricultural Production Section of the Office of Foreign Relief and Rehabilitation Operations. He will serve overseas in the Mediterranean area.

GORDON E. MCCALLUM, sanitary engineer, U. S. Public Health Service, who has been acting chief of the Sanitary Engineering Section of the Medical Division of the Office of Civilian Defense since January, 1943, has been designated chief sanitary engineer in charge of the section. Mr. McCallum was assigned to the Medical Division in 1941 as regional sanitary engineer for the Third Civilian Defense Region (Maryland, Virginia, Pennsylvania and the District of Columbia) and the States of Ohio and West Virginia, and later was made assistant chief sanitary engineer. Charles I. Mansur, formerly assistant civil engineer at the U. S. Waterways Experiment Station, Vicksburg, Miss., has joined the staff.

DR. LUDWIK GROSS, research associate of the Institute of Medical Research of the Christ Hospital, Cincinnati, has been ordered for duty as Captain in the Medical Corps, U. S. Army. His experimental study on acquired immunity against tumors will be interrupted for the duration of the war.

THE *Times*, London, states that E. Twentyman has been appointed British representative on the interim commission, which was set up by the Hot Springs Food Conference. Mr. Twentyman, who formerly worked at the Treasury Department, is second secretary to the Ministry of Food and is serving as a member of the British Food Mission in Washington.

ACCORDING to plans approved on August 19 by the State Board of Regents, the New York State College of Agriculture at Ithaca and the New York State Agricultural Experiment Station at Geneva will benefit by $7,000,000 in post-war construction. The board acted on the recommendation of its committee on post-war planning in education, of which Vice-Chancellor William J. Wallin, of Yonkers, is chairman. The board already has approved $36,000,000 worth of post-war construction for the educational system of the state. The entire program is subject to the approval of the Temporary State Commission for Post-War Public Work Planning. The New York State College of Agriculture has been allotted $5,619,000 for future building plans, which include nine projects, among them two units costing more than $1,000,000 each. The experimental station at Geneva will receive, according to the plans, $1,777,926 for four building units.

THE will of the late John H. Eagle, Philadelphia silk manufacturer, who died last month, bequeaths his estate, estimated at $7,000,000, after a bequest of $1,000,000 to Mrs. Eagle, to the California Institute of Technology and the Salvation Army. The fund for the institute will be used in the prevention and cure of disease and will be known as the John E. Eagle Endowment. It provides for prizes for distinguished service to humanity in the fields of chemistry, physics, medicine and other scientific endeavor.

DRAKE UNIVERSITY has received the sum of $200,000 from the Gardner Cowles Foundation, Des Moines, with which to erect a new science building to be known as Harvey Ingham Science Hall as a tribute to Harvey Ingham, editor emeritus of the *Des Moines Register and Tribune*, who will celebrate his eighty-fifth birthday next month.

THE *Journal* of the American Medical Association states that the State Charities Aid Association has received a grant of $19,000 from the Commonwealth Fund to enable the mental hygiene commission to prepare a plan for aiding men rejected or discharged by the armed forces because of neuropsychiatric conditions. The money became available on July 1.

THE National Society for the Prevention of Blindness announces the award of a prize of $250 for the most original paper adding to the present knowledge of medical treatment of non-congestive glaucoma. This prize is being offered in addition to one that was previously announced for the most valuable original paper concerning early diagnosis.

Nature states that the Royal Society of Arts, London, offers a prize under the Thomas Gray Memorial Trust, the objects of which are "The Advancement of the Science of Navigation and the Scientific and Educational interests of the British Mercantile Marine." The prize is of £50 and is open to any person of British or Allied nationality who may bring to the notice of the society an invention, publication, diagram, etc., which in the opinion of the judges is considered to be an advancement in the science or practice of navigation, proposed or invented by himself during the period from January 1, 1938, to December 31, 1943. Entries that have already been considered by the judges in the years 1938–42 are not eligible for further consideration unless they have since been materially modified. Competitors must forward their proofs of claim between October 1 and December 31 to the Acting Secretary, Royal Society of Arts.

SCIENTIFIC research to develop tests for measuring the intellectual and performance capacities of spastic children will be undertaken by the University of Southern California as the result of an initial endowment of $5,000 made recently by the Crippled Children's Society of Los Angeles County and the California State Society for Crippled Children. The particular phase of the study is being undertaken for the first time and will be supported over a period of five years. Volunteer public and professional organizations, as well as individuals dealing with spastic children, will have access to the psychometric clinic, which is a unit of the department of psychology.

MRS. F. W. WOZENCRAFT, of Washington, D. C., has presented a fund for a lectureship in ophthalmology at the School of Medicine of the University of Texas, in honor of her father, the late Dr. W. J. McReynolds, of Dallas, known for his work on the comparative anatomy of the crystalline lens.

AN Associated Press dispatch dated August 6 states that Secretary Ickes has announced the apportionment of $910,000 to various states for improvement of wildlife conditions. States are required to put up 25 per cent. more to obtain the Federal grants. Federal funds used for the program come from the 10 per cent. excise tax on any ammunition and on sporting arms. The money can be spent only as the Congress authorizes. For this year it approved $1,000,000. Eight per cent. will go for administrative purposes, $9,000 for restoration work in Alaska, $1,000 to the Virgin Islands and the rest to participating states in accordance with their area and number of licensed hunters. Allotments include Connecticut, $2,671; New Jersey, $8,596, and New York, $40,307.

THE Australian correspondent of the *Journal* of the American Medical Association reports that during the past two years the possibilities of agar-agar production in Australia and New Zealand have been explored. In Australia agar is being produced from a red seaweed, *Gracilaria confervoides*, which is easily harvested and is available in quantity. The results so far achieved have been promising. The agar produced has a higher ash and lower nitrogen content than the Japanese variety and a somewhat lower gelling power, but has provided suitable media for the growth of most bacteria. In New Zealand two species of Gelidiaceae offer commercial possibilities owing to their relative abundance, easy identification and good yield. Last year the Council for Scientific and Industrial Research carried out small-scale experiments with one of these, *Pterocladia lucida*, with satisfactory results. Further investigations are now in progress.

DISCUSSION

ARBITRARY EDITORIAL CHANGES IN SCIENTIFIC PAPERS

The value of proper editing of scientific papers can hardly be questioned. The present writer would be the last to deny that many of his papers have been notably improved by judicious changes requested by the editorial staff of the journals in which they were published. Editors have in general the advantage of age, experience, impartiality and a knowledge of the audience the journal is designed to reach. I have no intention of attacking the procedures of scientific editors in general. However, when nearly every manuscript accepted by a certain journal has its style completely reworked, often without obvious improvement in clarity, there is evidently more room for question. I refer to the changes which are made in two journals in this country which carry many papers dealing with immunology and related subjects. Accepted manuscripts are altered, without consulting the authors, to conform to certain unpublished stylistic preferences of certain of the editors. Among these preferences there evidently figure prominently the addition of an adjectival ending to any word used as an adjective, or if this is not possible, putting a hyphen between the adjectival noun and the noun it modifies, and a ban on words derived from a Latin and a Greek root simultaneously, except in the case of very common words such as automobile. Thus "horse serum" will be changed to "equine serum," or perhaps occasionally "horse-serum," and "monovalent" will be changed to "univalent."

In many cases, no doubt, these changes do not have any particular effect on the sense, and are neither good nor bad. However, cases do occur in which it is open to question whether the meaning remains unimpaired by the change. The flavor of "proteic molecule" is not quite the same as that of "protein molecule," and few, certainly, speak of "proteic chemistry." It may be doubted if a "microscopic slide" is exactly the same as a "microscope slide." In some cases the change definitely seems to be at the expense of clarity. To cite a personal instance, whenever I see "viral antigen" I am irresistibly reminded of "spiral antigen," and thus of protein chains coiling and uncoiling, and the resulting train of thought completely distracts my attention from what the author was trying to say. The difficulties of precise scientific writing seem to be quite great enough without needlessly putting additional mental hurdles in the reader's way in the shape of novel adjectival forms. "Virus antigen" is traditional, it is understood, and I fail to see why it is not good enough.

Sometimes the change to an adjective would clearly modify the author's meaning disastrously. I need only mention "nitrogenous factor," "antigenic extract," "mortal curve," "chesty specialist," and "bloody group." A colleague has inquired what would become of "toothache." Would it be changed to "dental ache," or, to avoid mixing Latin and Anglo-Saxon, to "toothic ache"? The editors would doubtless reply that "toothache" is already one word. All right, but is not "horse serum" really just as much one word, even though we write it as two?

When it is clearly impossible to change to an adjectival form, the editors I am referring to generally insert a hyphen, as "microscope-slide," "phage-antibody," but it is not easy to see how the mere insertion of a hyphen, which has no effect on the pronunciation, is of any value except as a sop to the editorial conscience. Whatever the language may look like when written, it essentially consists of a series of sounds in the mouths of those who speak it, and no number of diacritical marks will change this fact. Some visual aids, such as capital letters and quotation marks, have their value, but one could hardly say the same of that extra hyphen.

If we wish to be really impartial in this problem, there are perhaps two main questions we should try to answer. One is to consider what kind of a language English essentially is and what are the probable trends in regard to the use of endings, and the other is, what are the preferences of those who are actually writing scientific English to-day? If a majority of immunologists are opposed to changing nouns to adjectives, then it would hardly seem justified for the editors of one or two journals to make such changes without authorization.

In so far as the first point is concerned, there can be hardly any doubt that English is a language which tends to use words in different grammatical connections without always changing their forms, and that this tendency has in the past few centuries been on the increase. Our language is descended from the highly inflected Anglo-Saxon. While the impact of French may have had something to do with the change, the theory of some students is that the complexity of case endings, conjugations, etc., eventually became too much for even the Anglo-Saxons themselves, and finding themselves unable to keep track of the multitude of endings, they gradually dropped most of them. Whatever the reason, English is one of the least inflected languages of Europe, but few will maintain it has suffered as a result. Another great language, Chinese, has totally lost all inflections, but still seems to be able to cope with the task of expressing complicated ideas precisely.

As the opinion of an authority, we may quote the words of the great Danish philologist, Otto Jespersen, close student and lover of the English language, who stated:

> Besides, in a great many cases it is really contrary to the genius of the language to use an adjective at all. . . . *Birthday* is much more English than *natal day* . . . and *eyeball* than *ocular globe*. . . . Mere position before another noun is really the most English way of turning a noun into an adjective, *e.g.*, the *London* market, a *Wessex* man . . . a *Japan* table . . . a *Gladstone* bag, *imitation* Astrakhan. . . . The unnaturalness of forming Latin adjectives is, perhaps, also shown by the vacillation often found between different endings, as in *feudatary* and *feudatory*, *festal* and *festive*.[1]

If we examine the usage of great writers, we can find plenty of evidence that the use of nouns as adjectives is not foreign to the English language. Words like violet, marble, iron, etc., uncompromising as they sound, are all used as adjectives, and forms such as violaceous, marbly, ferrous, etc., have either been dropped, or retained in technical parlance only. Shakespeare says: "the Carthage queen," "Rome gates," "Tiber banks," "through faire Verona streets," "For canker vice the sweetest buds doth love," and Tennyson writes, "Every tiger madness muzzled, every serpent passion kill'd."

That this usage is not confined to poets may be seen by consulting Darwin, who says in the Origin of Species " . . . jackals and species of the cat genus. . . ."

The preference of present-day scientific writers can be studied directly. When I was writing a book on immunology, I took the opportunity of sending out questionnaires to about 30 persons who are either engaged in editing journals in which immunological papers often appear, or who have in the last few years published a number of papers on this subject. Each individual was asked to choose the form he preferred out of a choice of two or three. Not all replied, but the majority did, some with the addition of pencilled notes of encouragement. The pertinent data are shown in Table 1, where the numbers in parentheses show the number of replies favoring the form in question.

TABLE 1

pneumococcus polysaccharide(14), pneumococcal polysaccharide(5)
horse serum(22), equine serum(1), serum of the horse(1)
precipitin test(18), precipitative test(2), precipitation-test(5)
agglutination reaction(20), agglutinative reaction(3)
protein molecule(20), proteic molecule(2), molecule of protein(2)
diphtheria toxin(19), diphtheric toxin(3), diphtherial toxin(3)
inhibition reaction(14), inhibitive reaction(13)
inhibition zone(10), inhibitive zone(2)
antibody formation(14), antibody-formation(9), formation of antibody(6)
antibody specificity(18), antibody-specificity(6), anticorporeal specificity (0)
antigen molecule(14), antigenic molecule(7), antigen-molecule(3)
flocculation reaction(20), flocculative reaction(3).

It is clear that in most cases the majority were decidedly not in favor of adjectival forms. In regard to "pneumococcus" and "pneumococcal" the percentages run 74 against and only 26 for, but in other cases the verdict is even more conclusive. It will be noted that only one person interrogated preferred "equine serum" to "horse serum," and it may be definitely suspected that this was one of the editors responsible for the recent adjectival rash!

In view of the arguments based upon the obvious tendencies in the evolution of English as a language, the examples from classical authors and the clear indication of preference of those who are actually engaged in publishing the results of immunological research, may we venture to hope that in future the use of adjectives will be left to the authors as a purely personal matter? Surely, in this matter, as in others, we shall progress fastest, not by totalitarian compulsion, but by democratic cooperation.

WILLIAM C. BOYD

BOSTON UNIVERSITY
SCHOOL OF MEDICINE

GEOLOGY TEXTS FOR LATIN AMERICA

IN SCIENCE for July 2, E. Raymond Hall suggested that advanced scientific texts of North American origin be placed within financial reach of Latin American students. To every one interested in improved relations among Portuguese, English and Spanish-speaking Americans the suggestion is worthy not only of consideration but of immediate action.

A considerable proportion of Latin American colleges are the equivalent of North American junior colleges and in these only introductory courses are offered in many sciences. Among fields usually so treated is geology. The demand, both actual and potential, for English texts in geology is small, due both to small enrolments in such courses and to the prohibitive price of English texts. Frequently the text used is either Italian, German or French in origin. There is no reason why the study should be neglected, nor any reason why the attention of the beginning Latin American student should be turned toward the east, when it could be directed northward.

---

[1] "Growth and Structure of the English Language," p. 131, 3rd ed. Teubner, Leipzig, 1919.

Geological texts by North American authors, in both Portuguese and Spanish, would do much in stimulating interest in the science itself and even more in promoting hemispheric goodwill. Why should there not be set in motion a cooperative project which would make available excellent texts in physical, historical, structural and economic geology, optical mineralogy, paleontology, etc., in a language, format, binding and price with which Latin American students are familiar?

May it be suggested that each of the various geological societies undertake the publication of a text in their respective fields? The project is herewith submitted to members of the societies with these recommendations:

1. Let an appropriate committee of the American Association for the Advancement of Science learn by inquiry of Latin American educators and geological groups what types of texts would be most welcome.
2. Let the appropriate geological society in the U. S. appoint a group of its members who are willing to donate their services and assign to each of the group chapters of the text for which they shall be responsible.
3. Let the appropriate society sponsor translation into Portuguese and Spanish and first publication of the text in a number determined by inquiry of possible demand, say, for the next three or four years.
4. Let the texts be published by one of the many reputable Latin American publishing companies.
5. Let the texts be marketed through the same or similar agencies, at a cost well within reach of the group for whose use it is intended.
6. Let each text carry an introductory page setting forth the name and nature of the sponsoring society, an invitation for closer Inter-American scientific cooperation and a list of contributing authors.
7. And finally, let action be taken now. These are fast-moving times.

Hobart E. Stocking

West View, Pa.

COLORED TRANSPARENCIES OF TROPICAL PLANTS

The Arctic, Desert and Tropic Information Center has recently received requests as to where colored transparencies or colored photographs of tropical plants may be secured for use or for reproduction purposes. This material has been requested for use in intensive courses of instruction being given by various Army Air Forces Training Units. It is desired to assist army personnel in the recognition of both edible and poisonous plants and fruit in the tropical areas of the present world-wide theaters of operation.

Many of the country's larger and better known museums and scientific institutions have been contacted by the Arctic, Desert and Tropic Information Center with rather discouraging results. To date no appreciable number of the desired colored transparencies have been located.

Because of the wide and select distribution of Science among American scientists, it has occurred to us that the insertion of a brief notice in this journal stating the urgent need for this materiel might bring prompt results.

Elmer W. Ellsworth,
Captain, Air Corps; Chief, Information Collecting and Records Section, ADTIC

CROWN-GALL BACTERIA

Science Service has just published in Science, 98: 10, August 13, 1943, a note on "Plant tumor bacteria" which I should like to amend since it credits me with investigations which belong to other workers. The article was prepared from an unannotated summary of work on this subject. Science Service erroneously but innocently assumed that the results summarized were all my own. This was not the case.

The work on attenuation of crown-gall bacteria by cultivation on a medium containing glycine was done by Dr. A. J. Riker at the University of Wisconsin; that on the combined action of attenuated crown-gall bacteria and plant-growth-promoting substances was done at the Rockefeller Institute by Drs. Armin C. Braun and T. Laskaris; that on heat therapy of crown-gall disease in the Madagascar periwinkle was done by Drs. L. O. Kunkel and Armin C. Braun, also at the Rockefeller Institute. I should like to disclaim any direct connection with these investigations. Credit for them belongs to Drs. Riker, Braun, Laskaris and Kunkel, not to me.

Philip R. White

Rockefeller Institute
for Medical Research

SCIENTIFIC BOOKS

ORGANIC CHEMISTRY

Organic Syntheses. Collective Volume 2. A Revised Edition of Annual Volumes x–xix. Edited by A. H. Blatt. ix + 654 pp. 6 × 9¼ in. Bound in dark green cloth. New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd. 1943. $6.50.

The advent of this new collective volume, describing the preparation of nearly 300 typical organic compounds, will be warmly welcomed by all organic chemists who, with the second edition of Collective Vol. 1, will now have in two compact volumes all the material contained in the first 19 annual volumes of Organic Syntheses, revised and brought up to date, with tables of contents and thumb indexes covering Type of Reaction Index, Type of Compound Index, Formula Index, Illustration Index and General Index. In its preparation, the editor had the assistance of an editorial board of 18 recognized leaders in the field. In the main, it follows the general plan of Collective Volume 1.

In reviewing and revising the subject-matter of annual volumes x–xix, errors have been corrected, calculations, references and the spelling of names (particularly foreign ones) have been verified, modifications and improvements in procedure have been incorporated in the text, and 11 new and checked methods have been added.

As heretofore, the text covering every compound is divided into (1) Procedure, (2) Notes and (3) Methods of Preparation. The last includes all methods of preparative value recorded in *C. A.* up to the end of Vol. 35 (1941), and in some cases still later. A helpful feature is the inclusion in parentheses, under the name of the compound, of the *C. A.* indexing name, where that differs from the title given. Compounds whose preparation is described, but which can be purchased in the open market for $5 or less per kilogram, are marked with an asterisk.

Organic chemists can show their appreciation of the service rendered by the editor and his board in compiling this most useful volume, by forwarding (in duplicate) constructive suggestions for future volumes and calling attention to any errors of omission or commission.

In the judgment of the reviewer, this collective volume, like its predecessor, should be on the shelves of every well-equipped laboratory of synthetic organic chemistry.

Introduction to Organic and Biological Chemistry. By L. EARLE ARNOW, Ph.D., M.D. and HENRY C. REITZ, Ph.D. 6 × 8¾ in. 736 pp. Illustrated. Bound in dark blue cloth. St. Louis: The C. V. Mosby Co. 1943. $4.25.

As the authors point out, there are many excellent elementary text-books in organic as well as in biochemistry, but no single volume presenting the fundamentals of both fields concisely and coherently. This gap they have endeavored to fill, and the result is a text-book which should be both stimulating and helpful to all interested in the closer correlation of chemistry with the medical and biological sciences, particularly students in premedical, predental, agriculture, nutrition and dietetics, home economics, physical education and similar courses.

Like all Gaul, the book is divided into three parts. Part I (pp. 21–53) covers "Chemical Fundamentals in Review," its two chapters being devoted to "Chemical Facts and Theories" and "Particles in Solution." It is the authors' thought that this will serve mainly as a background to which the student can be referred whenever he exhibits signs of forgetting these fundamentals.

Part II (pp. 54–535) is devoted to "Organic Chemistry" and occupies nearly three fourths of the total book. The classification of its subject-matter follows conventional lines in the main, and is introduced by several pages of useful suggestions as to how to study "Organic Chemistry" most successfully. Another commendable feature of this part is the clothing of the dry bones of chemical facts and reactions with the flesh and blood of human interest and of the progress of civilization and industry.

Part III (pp. 536–694) deals with "Biological Chemistry," and is a summary of the more important phases of metabolism and nutrition, presented more from a chemical than from a physiological or anatomical point of view. An excellent "Summary of Nutritional Requirements" is included.

All the chapters conclude with a series of study questions; and nearly all of them with a list of references to books, monographs, reviews, etc., wherein the student will find additional information.

The Appendix, which contains the "1941 International Atomic Weights" and 16 pages of tables giving the "Composition and Calorific Value of Foods," is followed by an author index and a subject index. The 91 illustrations throughout the text add much to its attractiveness. Paper, type, printing and binding are excellent, and the book fulfills well the purpose for which it was written. The dedication to the late Ross Aiken Gortner touches the heart of the reviewer also, for Gortner was one of his "boys" of whom he was most proud.

Organic Syntheses. Vol. 23. An annual publication of satisfactory methods for the preparation of organic chemicals. LEE IRVIN SMITH, editor-in-chief, with an editorial board and an advisory board. Pp. 124. New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd. 1943. $1.75.

THIS new volume of a well-known, excellent and useful series in general follows closely the plan of its predecessors. New preparations described are the following: Acetylbenzoyl, Alloxan, Alloxantin Dihydrate, Bromoacetal, 3-Bromo-4-Hydroxytoluene, Carbobenzoxy Chloride and Derivatives, 1,1-Cyclobutanedicarboxylic Acid and Cyclobutanecarboxylic Acid, Cyclopropyl Cyanide, *beta*-Di-*n*-Butylaminoethylamine, 2,3-Dihydropyrane, *beta,beta*-Dimethylacrylic Acid, *beta*-Dimethylaminopropiophenone Hydrochloride, *beta*-Ethoxyethyl Bromide, *beta*-Ethoxypropionitrile, Ethyl Benzoylacetate, Ethyl Bromoacetate, Indole, Ketene Diethylacetal, Mandelic Acid, *l*-Menthoxyacetic Acid, l-Menthoxyacetyl Chloride, Mesitaldehyde, *beta*-Methylglutaric Acid, *beta*-Naphthaldehyde, *p*-Nitrobenzoyl Peroxide, Pentamethylene Bromide, *alpha*-Phenylethylamine, *beta*-Phenylethylamine, Phthalaldehydic Acid, Pseudoionone, 1(*alpha*-Pyridyl)-2-Propanol, *trans*-Stilbene, Tetrahydrofurfuryl Bromide, Tetrahydropyrane, Tetraphenylcyclopentadienone, Tetraphenylphthalic Anhydride, Tribiphenylcarbinol, Triphenylcarbinol, Triphenylchloromethane.

The subject index at the close is cumulative in the sense that it covers the contents of Volumes 20, 21, 22 and 23. The cumulative indexes for previous volumes in the series will be found in Collective Volumes 1 and 2. The series is so well established as the leader in its chosen field that no eulogy is necessary on the part of the reviewer.

MARSTON T. BOGERT

COLUMBIA UNIVERSITY

THE MOTHS OF SOUTH AFRICA

The Moths of South Africa. By A. J. T. JANSE. Vol. IV. Part I. (Published by the University of Pretoria, South Africa.)

WHEN my wife and I visited Pretoria in 1931, we called on Dr. Janse, and saw his wonderful collection of moths and his great and completely indexed library of works on Lepidoptera. We discussed the forthcoming revision of "The Moths of South Africa," and since that time the volumes have been coming out at long intervals, under circumstances of increasing difficulty. The present part contains a list of the subscribers, but of these, several are in enemy countries, and others are likely to have dropped out. The principal support has come from the National Research Council of the Union of South Africa, and we note that General Smuts has made a generous subscription.

The part just received (dated November, 1942) is of unusual interest because it deals with the most primitive Lepidoptera known, the Hepialids and the Micropterygids. The former are numerously represented in South Africa, with only one species, *Leto venus,* of large size and comparable with the large Australian forms. The genus *Leto* has also one species in New South Wales and one in the Fiji Islands, a distribution suggestive of great antiquity and approaching extinction. It is interesting to note that *Leto venus* has only been found at Knysna, the locality on the coast of South Africa noted for its relict fauna. The Micropterygids appeared to be absent from South Africa until in 1917 Janse took a single female specimen of a new genus and species at Karkloof, Natal. In 1930 he returned to the same spot and took a male, and these two alone represent the known South African Micropterygid fauna.

In the classification of moths, it has always been usual to place the Micropterygids at the bottom of the scale, as nearest to the caddis-flies, from which the Lepidoptera are supposed to have been derived. But Janse now classes the Hepialids as most primitive on various grounds, but thinks they originated quite apart from the Micropterygids, the Lepidoptera being thus diphyletic.

The book is illustrated by eleven plates of Janse's exquisite drawings of structures and five photographic plates of moths. It is dedicated to the memory of Edward Meyrick of England, who described more Microlepidoptera than any one else and a bibliography of Meyrick's publications is included.

T. D. A. COCKERELL

SPECIAL ARTICLES

ON THE TYPE OF CHOLINESTERASE PRESENT IN BRAIN TISSUE[1]

Two esterases capable of hydrolyzing acetylcholine have been shown[2] to exist in the animal body: a true cholinesterase, acting exclusively on certain choline esters, and a non-specific enzyme hydrolyzing not only esters of choline but a variety of non-choline esters as well. The true cholinesterase exhibits its maximum activity at low concentrations of acetylcholine (around 3 mg per cent.) and displays increasing inhibition with rising substrate concentrations, whereas the non-specific enzyme exhibits its greatest activity at high concentrations of acetylcholine (above 300 mg per cent.) and displays decreasing activity with diminishing concentrations of this substrate. Since the physiological function of the non-specific enzyme is as yet unknown it has been provisionally named pseudo-cholinesterase.

In view of the differences in activity of the two enzymes at high and low concentrations of acetylcholine, measurements at these two substrate concentrations can serve to indicate whether true cholinesterase or pseudo-cholinesterase predominates in various tissues or body fluids.

---

[1] A preliminary report on this investigation, which was aided by a grant from the Banting Research Foundation, was presented before the Toronto Physiological Society on December 2, 1942.

[2] B. Mendel and H. Rudney, *Biochem. Jour.*, 37: 59, 1943.

Recently we have found[3] that acetyl-beta-methylcholine is hydrolyzed only by true cholinesterase and not by pseudo-cholinesterase, whereas benzoylcholine is hydrolyzed only by pseudo-cholinesterase and not by true cholinesterase. These facts make it possible to estimate quantitatively the activities of the true cholinesterase and the pseudo-cholinesterase separately in any mixture of the two enzymes.

Using this method determinations were carried out on the same organs of various species in order to ascertain which type of cholinesterase is present.

Since cholinesterase plays an essential role in the chemical transmission of nerve impulses,[4] it was deemed of great importance to find out which of the two enzymes is present in brain tissue. Gray and white matter from the brain of representatives of all the vertebrate classes were investigated. In addition, various other organs, such as parotid gland and pancreas, of several mammalian species were tested. The results are tabulated below (Table 1).

TABLE 1

TYPE OF CHOLINESTERASE PRESENT IN:

	Brain	Parotid gland	Pancreas
Rat	true		
Mouse	true		
Guinea pig	true	pseudo-*	
Rabbit	true	true	
Dog	true	mixture	pseudo-*
Cat	true	mixture	true
Cow	true	true	
Pig	true	pseudo-*	
Chicken	true		
Turtle	true		
Frog	true		
Carp	true		

* Traces of true cholinesterase present.

The results listed in Table 1 show that the brains of all the vertebrates tested contain only true cholinesterase and no pseudo-cholinesterase. This fact demonstrates that in brain tissue it is the true cholinesterase which performs the function of hydrolyzing acetylcholine after it has been liberated.

The other organs tested, however, show no regularity as to the type of cholinesterase present, *e.g.*, the parotid glands of various species may contain true cholinesterase or pseudo-cholinesterase or both. Similarly, the pancreas of the cat contains only true cholinesterase, while that of the dog contains only pseudo-cholinesterase.

Summary: Brain tissue of all vertebrates contains only true cholinesterase.

No general statement concerning the type of cholinesterase in any other organ can be made, since true cholinesterase may be present in a particular organ of one species and pseudo-cholinesterase in the same organ of another.

BRUNO MENDEL
HARRY RUDNEY

BANTING AND BEST DEPARTMENT
OF MEDICAL RESEARCH,
UNIVERSITY OF TORONTO

---

[3] B. Mendel, D. B. Mundell and H. Rudney, in press (*Biochem. Jour.*)

[4] B. Mendel and R. D. Hawkins, in press, *Jour. Neurophysiol.*, 99.

ENTRANCE OF CHLORIDE WITH POTASSIUM INTO LIVE RAT MUSCLE FIBERS—CL-SPACE ERROR

THE muscle of animals after adrenalectomy with high plasma potassium contains more extracellular fluid[1, 2] expressed as Cl-space (*liters* of *plasma water* calculated to contain all Cl in 1 kg muscle) than after DOCA therapy[3] when *plasma* K is low. This result, surprising in view of Na retention in the latter case, may be elucidated by, in fact, is a good test of, the Boyle and Conway[4] theory, in which Cl enters muscle fibers as KCl in a Donnan equilibrium. Tested to date only in excised and immersed frog muscle, the theory is now tried in live rats. Conditions predicted to increase fiber Cl were imposed: a doubled plasma K and an 11 per cent. increase in fiber water. Fiber Cl, designated as Cl- minus inulin-space, increased 75 per cent. The error involved by designation of extracellular fluid as Cl-space, error expressed as (Cl- minus inulin-space)/(inulin space), is 44 per cent. before, 58 per cent. after imposing the condition. Thus the Cl-space error is not only absolute[5] but also dynamic or functional. Thiocyanate-space should involve similar errors.

Of rats nephrectomized under ether, litter mate A received intraperitoneally 66 ml/kg of a solution containing 3.75 gm per cent. inulin or equivalent sucrose, 150 mM Na, 125 mM Cl, 25 mM bicarbonate; in mate B, 50 mM K replaced equivalent Na and only this rat received drinking water during the 22-hour equilibration. Only sheet muscles taken under amytal from the thighs were stripped into slender pieces and cleared of connective tissue, fat, and visible blood. The *same* zinc filtrate of muscle or plasma gave aliquots for the Volhard chloride and the Seliwanoff color reaction for inulin or sucrose as fructose.[6] The small uniform muscle "fructose" blank was deducted. Equilibrium was attained as revealed in comparable inulin- and sucrose-spaces and in comparable chloride and inulin values for plasma and the occasional peritoneal water.

---

[1] A. H. Hegnauer and E. J. Robinson, *Jour. Biol. Chem.*, 116: 769, 1936.

[2] D. C. Darrow, H. E. Harrison and M. Taffel, *Jour. Biol. Chem.*, 130: 487, 1939.

[3] D. C. Darrow and H. C. Miller, *Jour. Clin. Investigation*, 21: 601, 1942.

[4] P. J. Boyle and E. J. Conway, *Jour. Physiol.*, 100: 1, 1941.

[5] L. V. Heilbrunn and P. G. Hamilton, *Physiol. Zoöl.*, 15: 363, 1942.

[6] K. Steinitz, *Jour. Biol. Chem.*, 126: 589, 1934.

Concentrations of Cl in fiber water, calculated as (Cl- minus inulin-space) (conc. Cl in plasma water)/(muscle water minus inulin-space), are matched with plasma K (chloroplatinate analysis[7]) in Table 1. The correlation is + 0.71 with a P value equal to 0.0014 that the scatter result from uncorrelated material. From Boyle and Conway, $Cl_1/d_1 = Cl/d$,[8] and if in the rat as in the frog $d_1 = K$, then $Cl_1 = (Cl/d) K$. The regression equation for the combined data of Table 1 is $Cl_1 = 0.28 + 0.795\ K$. With $(Cl/d) = .795 = 107.5/d$,[9] $d = 135.2$ and $d - Cl = 27.7$, a very likely value for diffusible anions other than Cl in plasma, particularly bicarbonate.

TABLE 1

PLASMA K AND MUSCLE FIBER CL IN RATS
MM./L. OF PLASMA OR FIBER WATER

Group A		Group B	
Plasma K	Fiber Cl	Plasma K	Fiber Cl
6.9	4.9	8.8	7.7
7.0	10.7	10.7	10.3
7.4	1.9	10.8	8.2
8.5	9.0	11.8	7.0
8.1	8.0	. . .	10.0
8.3	7.0	12.4	12.1
8.6	2.5	14.2	11.6
10.1	9.0	14.7	12.9
14.9	13.2	15.9	11.2

The negative correlation − 0.21, P = 0.20, between plasma Cl and fiber Cl/unit dry weight, though determined over a limited range of plasma Cl values, does not support adsorption of Cl as such. It may mean, if any of the plasma *K* in nephrectomy comes from endogenous source in company with anions other than *Cl*, a reduction of plasma *Cl* as this *Cl* enters the fibers with *K*. Such transfer may explain instances of fall in plasma *Cl* when the kidney is excluded and plasma *K* elevated: chronic nephritis, adrenaline release, hemorrhage, shock, asphyxia, local venous stasis, etc.; and, of course, the opposite when plasma *K* is lowered: excess cortical hormone, anesthesia.

The muscles of group A contained an inulin-space 15.8 per cent. larger than those of B. This suggests the inability of *K* compared to *Na* to support interstitial fluid bulk even after nephrectomy. Entrance into fibers of *K* as KCl from fluids containing *K* substituted for Na naturally entails entrance of water because of hypotonicity. Entrance of *K* in exchange for *Na*, assuming equal ionization inside, would involve no water shift.

WALTER S. WILDE
DEPARTMENT OF PHYSIOLOGY,
SCHOOL OF MEDICINE,
LOUISIANA STATE UNIVERSITY

---

[7] W. S. Wilde, *Jour. Biol. Chem.*, 128: 309, 1939.

[8] Italicized symbols represent "activities"; d = sum of diffusible anions; subscripts indicate "fiber" ions, other ions being interstitial.

[9] 107.5 is mean plasma water Cl for all rats.

PIGMENT PRODUCTION BY TUBERCLE BACILLUS IN THE PRESENCE OF P-AMINOBENZOIC ACID

PURSUING studies on the chemotherapeutic relationship between Mycobacterium tuberculosis and fungi,[1] an intensive yellow pigmentation has been observed in cultures of a certain strain of *Tubercle bacillus* when grown in the presence of high concentrations of p-aminobenzoic acid (PABA). That the formation of this kind of pigment apparently is not restricted to the *Tubercle bacilli* and has perhaps a general significance is suggested by a recent publication by Spink and Vivino.[2] These authors described the development of a yellow pigment in cultures of staphylococci when grown in the presence of sulfa drugs.

Strain No. 607 of the American Type Culture Collection, growing first in Sauton's, later in Long's medium, was employed for the study reported here. Formation of the yellow pigment takes place in PABA concentrations of 1:1000 to 1:3000 after an incubation of about one week. At first the color is a bright yellow, but the cultures often gradually become brownish. Numerous conglomerations of yellow crystals are visible microscopically between and around the bacilli which occasionally grow like fungi in long threads and chains. No similar coloration could be observed in the presence of sulfathiazole, sulfathiourea, aniline, sulfanilic acid or paraphenylenediamine.

Benzoyl-γ-(2-methylpiperidino)-propanol hydrochloride, selected as an example of an amine-free derivative of benzoic acid, was without effect; by contrast, p-aminobenzoyl-diethylaminoethanol hydrochloride (Procaine) gave a very intense color if concentrations of 1:250 to 1:500 were used. (Notice that this quantitative relation between PABA and Procaine is about the same as in their antisulfonamide activities.)

Since the tubercle bacillus forms considerable amounts of riboflavin under identical conditions, I first considered the possibility of an increased riboflavin formation due to the presence of PABA; my recent findings, however, indicate that the yellow pigment here described is not identical with Vitamin B_2. In the absence of PABA no pigment is formed if the magnesium content of the medium is changed or if mercuric chloride is added to the medium. It is known that changing the concentration of magnesium or addition of $HgCl_2$ increases considerably the riboflavin formation by *Aspergillus niger*.[3]

The pigment is insoluble in ether, chloroform or petrol ether, but it is highly soluble in concentrated acetic acid and phenol. Under the microscope, tubercle bacilli containing this pigment reduce ammoniacal $AgNO_3$ and Fehling's solution.

---

[1] R. L. Mayer, *Revue Medical France*, December, 1941, 3–19; see C.A. 36: 5199, 1942.

[2] W. W. Spink and J. J. Vivino, SCIENCE, 98: 44, 1493.

[3] G. S. Kitavin, *Cpt. rend. acad. Sci. URSS*, 28: 517, 1940.

Studies are under way in order to determine the possible relationship of this pigment to a metabolite derived from PABA and especially to factors of the vitamin B complex.

RUDOLF L. MAYER

RESEARCH LABORATORIES,
CIBA PHARMACEUTICAL PRODUCTS, INC.,
SUMMIT, N. J.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

GLYOXAL, A NON-IRRITATING ALDEHYDE SUGGESTED AS SUBSTITUTE FOR FORMALIN IN HISTOLOGICAL FIXATIONS

MANY histologists who find the traditional formaldehyde solution distressing to the eyes and nose would doubtless welcome a less offensive hardening agent of equal efficiency. Glyoxal, or oxalic aldehyde, which has recently become available[1] in fair quantities, appears very promising in this respect.

Glyoxal, whose molecule consists merely of two linked aldehydic groups, and is the simplest of the dialdehydes, has been recommended by the manufacturers as an "insolublizing agent" for protein materials such as casein, albumin, gelatin and glues. This suggested to us that perhaps the dialdehyde could also be applied for hardening animal tissues in histological fixation.

A variety of tissues of the mouse was tried in different strengths of glyoxal. Reasoning that the ordinary "10 per cent. formalin" is approximately a 4 per cent. formaldehyde solution, and that glyoxal has two aldehyde groups, one would expect a 2 per cent. solution to be about right. Liver, kidney, muscle of leg, tongue, heart, skin, spleen, lung, brain and fatty tissue of the breast of mouse were used and of human breast tissue and brain. With small blocks of tissue, we found the 2 per cent. glyoxal to compare very favorably with 10 per cent. formalin, with the possible exception of muscle. Nuclei were well stained in all specimens. Even a 1 per cent. glyoxal solution was adequate for small samples of many tissues. Concentrations much higher than 2 per cent. were not suitable for small blocks. The addition of acetic acid yielded poorer results. Controls were run with 10 per cent. formalin. Only haematoxylin-eosin stain was employed, no difference being noted in the coloration of tissues between those fixed in formalin and glyoxal.

When large masses of tissue, such as an entire human brain, were fixed, 10 per cent. concentration and slightly longer time was necessary. Either the weaker solution was exhausted or the larger glyoxal molecule does not diffuse as readily as formaldehyde.

Glyoxal is now supplied as a crude 30 per cent. to 40 per cent. aqueous solution, deep yellow and syrupy in consistency. It is quite impure and too acidic to be used without treatment. Dilute the crude solution to 10 per cent. concentration with tap water. Add powdered calcium carbonate, and stir until effervescence ceases. Frothing is severe but can be controlled by adding a little ethyl ether. Filter by suction through a rapid crepe paper. Pass through a second time if not clear. Dilute further to 2 per cent., or as desired. The final solution will be still faintly acidic (to litmus) and should be left so, never alkaline. It has only a weak odor and is not irritating.

A 30–40 per cent. crude solution of glyoxal sells for one dollar a pound in lots of a gallon or under. However, at 2 per cent. dilution it costs only about 10 to 15 cents a liter. It is expected to become cheaper and more abundant, but even now 50 gallons of the 30–40 per cent. concentration can be purchased on one order.

L. F. WICKS
V. SUNTZEFF

THE BARNARD FREE SKIN AND
CANCER HOSPITAL,
ST. LOUIS, MO.

---

[1] Carbide and Carbon Chemicals Corporation, 30 East 42nd St., New York. We are most grateful to F. J. Rauscher of the St. Louis office for generous samples of glyoxal solution.

BOOKS RECEIVED

BRODE, WALLACE R. *Chemical Spectroscopy.* Illustrated. Pp. xi + 677. John Wiley and Sons. $6.50.

GIST, NOEL P., C. T. PIHLBLAD and CECIL D. GREGORY. *Selective Factors in Migration and Occupation.* Pp. 166. University of Missouri. $1.50.

HUGHES, WENDELL L. *Reconstructive Surgery of the Eyelids.* Illustrated. Pp. 160. C. V. Mosby Company.

JESSEE, RUTH W. *Self-Teaching Tests in Arithmetic for Nurses.* Pp. 111. C. V. Mosby Company.

MEHLIG, MADELINE FESS. *Kitchen Strategy. Food Planning for Victory.* Illustrated. Pp. vii + 131. Grosset and Dunlap. $1.29.

POSTEL, A. WILLIAMS. *The Mineral Resources of Africa.* Illustrated. Pp. 105. University of Pennsylvania Press. $1.50.

STEWART, H., A. NICHOLS, S. A. WALLING and J. C. HILL. *Aircraft Navigation.* Illustrated. Pp. iv + 146. Macmillan Company. $2.00.

TRUBY, ALBERT E. *Memoir of Walter Reed. The Yellow Fever Episode.* Illustrated. Pp. xiii + 289. Harper and Brothers. $3.50.

WOLF, STEWART and HAROLD G. WOLFF. *Human Gastric Function. An Experimental Study of a Man and His Stomach.* Illustrated. Pp. xv + 195. Oxford University Press.

WORTHING, ARCHIE G. and JOSEPH GEFFNER. *Treatment of Experimental Data.* Illustrated. Pp. ix + 342. John Wiley and Sons. $4.50.

SCIENCE

Vol. 98 FRIDAY, SEPTEMBER 3, 1943 No. 2540

Branches of the Academy of Sciences of the USSR: DR. P. KOLESNIKOV 205

Imaginary Submarine Canyons: DR. FRANCIS P. SHEPARD 208

Obituary:

Albro D. Morrill: DR. WALTER N. HESS. *Elizabeth Towar Platt:* PROFESSOR RALPH H. BROWN. *Recent Deaths* 210

Scientific Events:

The National Academy of Peiping; The University of London; The American Association of Cereal Chemists and the Kilgore Bill; Visual Instruction in Microbiology; The Pittsburgh Meeting of the American Chemical Society; Awards of Sigma Xi Grants-in-Aid of Research 212

Scientific Notes and News 214

Discussion:

Prevention of Oral Lesions in B_1 Avitaminotic Dogs: DR. WM. M. GOVIER and DR. MARGARET E. GREIG. *The Growth of an Ice Sheet:* PROFESSOR WM. H. HOBBS. *The Curtailment of Military Psychology in Germany:* DR. H. L. ANSBACHER. *Transliteration of English Names in Russian:* DR. ALEŠ HRDLIČKA. *Arthur Willis Goodspeed:* DR. OTTO GLASSER 216

Quotations:

Pooling Research 219

Scientific Books:

Gases and Vapors: PROFESSOR ARTHUR B. LAMB. *Tissue Culture:* DR. CHARLES A. SHULL. *Essays in Biology in Honor of Herbert M. Evans:* PROFESSOR C. E. MCCLUNG 220

Special Articles:

The Effect of Propamidine on Bacterial Metabolism: DR. FREDERICK BERNHEIM. *The Effect of Propamidine on Bacterial Growth:* DR. HENRY I. KOHN. *The Nature of Myasthenia Gravis:* CLARA TORDA and DR. HAROLD G. WOLFF 223

Scientific Apparatus and Laboratory Methods:

Corticotropin Obtained by Ultrafiltration of Pituitary Extracts: DR. RICHARD TYSLOWITZ 225

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

BRANCHES OF THE ACADEMY OF SCIENCES OF THE USSR

By Dr. P. KOLESNIKOV

VICE-CHAIRMAN OF THE COMMITTEE OF BRANCHES AND BASES OF THE ACADEMY OF SCIENCES OF THE USSR

IN the Soviet Union the Academy of Sciences has become the greatest scientific center of the country, embracing scores of institutes and hundreds of laboratories.

The time has long since passed when science and art were the domain only of the capital and of a few of the larger cities. To-day science is making swift progress and scientific personnel are quickly growing in the most distant national regions of the USSR.

The Academy of Sciences of the USSR comprises several republican branches and scientific bases. Article 48 of the Statutes of the Academy of Sciences reads:

Branches of the Academy of Sciences in the locality constitute incorporated research institutes, while the local bases of the Academy of Sciences represent complexes of research institutes, these branches and bases studying the natural wealth, the economy and the culture of the respective individual Republic, Territory and Region.

Branches and bases of the Academy of Sciences of the USSR are located all over the country—from the Kola Peninsula to the foothills of the Pamir Mountains. There are also the following major scientific centers—the Academy of Sciences of the Georgian SSR, those of the Ukrainian SSR and the Byelorussian SSR and the USSR Academy branches in the Azerbaijan and the Uzbek Republics.

Branches of the Academy of Sciences of the USSR are also established in Armenia, Kazakhstan, Tajikistan and in the Urals. Then there is the Kola Base in the Trans-Polar regions, and the Northern Base—in Archangel.

Each of these branches embraces a group of scientific institutes, laboratories, stations, preserves and other institutions engaging in research.

Altogether the Academy of Sciences has eight local branches and two bases, comprising 29 institutes and 105 laboratories, stations, observatories, botanical gardens and other scientific establishments.

About 3,000 scientific and scientific-technical workers are engaged in these branches and bases, including 15 academicians, 5 corresponding members of the academy, over 400 doctors and masters of science and 300 postgraduate students.

A numerable native personnel of scientific workers has been established in the national republics where academy branches are located. In the Armenian Branch, for instance, 93 per cent. of the scientific workers are Armenians by birth, 73 per cent. of the workers in the Georgian Branch are native Georgians, etc.

The volume of printed publications serves as an indication of the growth of academy branches and bases; publications exceeding 5,000 printer's signatures—such is the total volume of titles put out by the branches and bases in the past few years. In 1940 alone the Georgian Academy of Sciences prepared for press and published various scientific works totaling about 1,000 printer's signatures; in that same year the Azerbaijan Branch published 610 signatures, the Armenian Branch 530 signatures, etc.

Practically all the academy branches have their own printing facilities, allowing scientific works to be published not only in the corresponding national language but also in Russian. The Azerbaijan and Uzbek branches publish scientific and popular-scientific periodicals in the respective languages.

In recent years the scientific institutions of the academy branches and bases have accomplished a large program of work closely bound up with the national economy and the cultural progress of the national republics. In 1940 alone 168 various scientific works (on geology, metallurgy, chemistry, agriculture, etc.) were introduced into the national economy.

Various organizations and enterprises enjoy the systematic consultation of the Academy of Sciences branches.

In conformity with the tasks posited by the Soviet government—that of strengthening the raw material base of separate districts—the academy branches have widely developed the prospecting of minerals and the study of the geography of these districts.

On the basis of scientific explorations (Professor Chernov) the Northern Base of the Academy of Sciences established that salt deposits are located near Kotlas, in the north, and coal at the Cheshskaya Bay. The subsequent prospecting by geological parties fully confirmed this forecast and the North is now faced with the practical problems of working its own salt for the White Sea and Murmansk fisheries and of mining local coal for the swiftly developing industries of the Trans-Polar regions.

The discovery of niobium ore deposits, made by a group of prospectors, has brought up the question of establishing a Soviet niobium industry.

The discovery of selenium and other, richer compounds of rare earths on the Kola Peninsula has placed new tasks before the non-ferrous and rare metals industry of the USSR.

The Georgian Academy of Sciences is successfully employing new geophysical methods in prospecting the copper deposits in Svanetia.

The Armenian Branch of the USSR Academy of Sciences has furnished the first precise data concerning the local aluminium ores, constituting a local raw material base for the aluminium industry of Soviet Armenia.

The Tajik Branch has finished working up materials on the mineral resources of the Tajik SSR and has indicated the vast reserves of superior narzan mineral waters on the territory of this republic. Another important discovery made by the scientific workers of the Tajik Branch was that of the deposits of iron ores (magnetites and hematites) in Ramitsi District and the determination of the geological reserves in the explored part of these deposits.

Professor Abramovich, of the Azerbaijan Branch, has collected material substantiating the assumption of distribution of petroleum in strata, the direction of flow of oil to the well and the approximate determination of the change in the properties of petroleum when worked.

Expeditions of the Azerbaijan Branch have amassed considerable material on the geology, tectonics, petrography and mineralogy of the barite deposits in the Chavdar and other areas of the basin of the River Ter-ter. In 1940, on the basis of these data furnished by the expeditions, the Azerbaijan Geological Board conducted wide-scale and detailed prospecting of barites.

Gabrielyan, a scientific collaborator of the Uzbek Branch, has evolved a method for combating sand jamming during the exploitation of oil wells.

Another equally important work—that of Krylov, also collaborating in the Uzbek Branch—gives new foundations proving the presence of fresh water in the Golodny desert steppes, occurring at great depths in the crushed rocks and relating to the ancient beds of the Cherchik and Angren rivers. These conclusions are of major practical purport in projecting meliorative measures. The engineering-and-geological characteristics of the area of the stretch of the Northern Ferghana Canal—worked out by Krylov—and his estimations of the ground of different sections of this area which are destined to serve as the construction site for hydro-engineering structures, have been handed over for utilization to the corresponding People's Commissariat.

The scientific workers of the Armenian Branch have made a geological study of the Akverian marble deposits which are to-day being extensively quarried to supply material for the construction of the Palace of Soviets, the Moscow Metro Railway, etc. Several new marble deposits have been located, and the Armenian Marble Trust has been entrusted with making a detailed prospecting survey of them.

An expedition equipped by the Kazakh Branch of the USSR Academy of Sciences has discovered considerable quantities of tin at the Pavdin deposits, which had been hitherto known only for their deposits of copper. This expedition likewise established the presence of bismuth in the polymetallic ores of the Akchibal deposits, in Central Kazakhstan. This substantially extends the area of occurrence of tin in the Kizyl-Este ore deposits.

The Urals Branch has brought its study of the suitability of Ural dunites to serve as fireclays to the stage of commercial utility in industry. This branch has also worked out methods for obtaining naturally alloyed metals by means of usual blast furnace smelting of the ore and has proved the possibility of obtaining niobium pig-iron by blast furnace process. This academy branch has likewise established the agglomerative properties of loparite concentrates, thus making it feasible to widely utilize the niobium ores for the production of special steels.

The possibilities of utilizing the waste products after concentration of the Kusin titano-magnetites have likewise been proved feasible. This will reduce the cost of agglomerates produced by the plant.

The Urals Branch has also designed and constructed several types of precision instruments of much importance for industry. These appliances include a transportable kiloamper meter for a comparatively rough gauging of the strength of current, which is necessary in regulating electrolytic baths, a kilowatt-hour meter in which the electric current coil is replaced by a metal strip; besides this, improvements have been introduced in the magnet-wire of transformers. A rational system as well as methods and the requisite appliances have been designed for the factory control of the magnetic properties of transformer steels and the application of these devices in one of the Urals works resulted in a marked improvement in the quality of these steels. Finally, an improved method of magnetic defectoscopy has been worked out for testing track rails and parts of powerful, high-speed machines.

These undertakings allow the positing and solution of problems which could not have been solved before, when technology, chemistry and geology stood separated from each other. And it is this joint work of different specialists which forms one of the salient features of the local undertakings of the academy branches.

In this respect mention should be made of the work done in relation to petroleum. Oil, which abounds in the Apsheron Peninsula, particularly attracts the attention of geologists, physicists and chemists. Workers of the physics department of the Azerbaijan Academy have made an electric model of an oil stratus. By means of data characterizing the hydraulic permeability of the layer in separate points, this model makes it possible to judge of the distribution of oil throughout the whole stratum. This in turn enables the oil workers to sink the well in the most efficient manner, ensuring the maximum yield of petroleum. This method of electric modelling of oil strata—which has passed laboratory tests—is to be employed in the Azerbaijan oil fields.

Another interesting method worked out by the collaborators of the Azerbaijan Branch allows the hydraulic permeability of porous rocks drawn out of the well hole to be quickly measured—in ten minutes. This method will be of great utility not only in geology but also in hydro-engineering, metallurgy, soil study, chemistry, etc.

The vast construction now proceeding throughout the Soviet Union requires a tremendous volume of building materials. Some of the academy branch institutes, in particular the Chemical Institute of the Uzbek Branch, have placed before themselves the task of cement production out of locally available raw material. This undertaking is finding successful solution in Central Asia, Professor Kancepolsky being in charge of this work here.

The investigations of the Chemical Institute of the Uzbek Branch have shown that the loess of the Khimkov deposits, containing 35 per cent. calcium carbonate, after processing, possesses particularly high binding properties and stability, exceeding that of the standard grades and requiring less fuel in manufacture.

Considerable works have been accomplished by the academy branches in the domain of biological sciences

—geobotanical studies of individual territories (the Kazakh Branch and the Kola Base), extending the pasture acreage and raising its productivity, measures aimed against salinification of the soil, work on increasing fodder resources, etc.

A number of botanical gardens, the high-mountain soil-and-botanical station on the Pamir Mountains and the Polar botanical gardens in Kirov study the local flora, raise various species of decorative plants and have introduced the cultivation of several wild-growing plants.

(*To be Concluded*)

IMAGINARY SUBMARINE CANYONS[1]

By Dr. FRANCIS P. SHEPARD

DIVISION OF WAR RESEARCH, UNIVERSITY OF CALIFORNIA, SAN DIEGO, CALIF.

THE VEATCH-SMITH SUBMARINE CONTOURS

FOR some years the discovery of the great submarine canyons along the oceanic slopes off the east coast filled many of the outstanding geological theorists with misgivings. They were less disturbed by the deeply submerged canyons with the characteristics of river valleys off California, since this coast was well known to be unstable, but river canyons off the supposedly stable east coast were unthinkable; and to make matters worse, charts were showing that submarine canyons were practically universal. Assuredly the continents of the world could not all have been moving up and down many thousands of feet during the late part of geological time. Into the breech at the critical moment stepped a series of maps of outstanding workmanship which appear to have taken at least the eastern part of the country by storm. These maps were the result of painstaking contouring by A. C. Veatch and by his collaborator, Paul Smith.[2] The contours, as both Veatch and Smith have frankly admitted, are based on the hypothesis that the submarine slopes have a stream-cut type of topography. Accordingly, the contours show a great mass of gullies and valleys even out at the greatest depths where there are few soundings. These small valleys shown on the maps have been seized on eagerly without any apparent attempt to determine their basis and are now established as the pièce de resistance of three new hypotheses advocating submarine origin of the canyons. Two of these have appeared in books[3] and a third as a short article.[4] The maps have also been reproduced in many textbooks and have been the source from which a model reposing in the American Museum of Natural History was drawn. Even *Life* magazine recently reproduced a picture of this model with mention in garbled form of one of the new hypotheses.

Since the tendency of late has been to regard these gullies as the typical submarine valleys and accordingly to disregard the great rock-walled canyons which have been revealed by years of scientific exploration of the sea floor, it might be well to give the scientific public some insight on the basis of these supposed gullies and their relation to the problem of the history of the ocean floors. Regarding these contours one must admit in all fairness that they represent long painstaking effort. Certainly it would have been difficult to fit stream-dissected slope topography more perfectly into the soundings than has been done. On the other hand, the contouring could have been executed with the same care in attempting to show what actually existed out on these submarine slopes off the east coast. That this was not done is indicated by the fact that the same soundings were contoured by a series of six topographers and geologists of the U. S. Geological Survey and by the present writer and his co-worker, K. O. Emery, and in no case did these closely spaced small valleys appear in the contoured maps which resulted. Instead of these myriads of gullies a series of relatively large canyons (shown also by Veatch and Smith) are revealed on the slopes. The canyons are of the type which recent theories have so meticulously avoided. In a forthcoming paper, Emery and the writer will present in some detail the abundant evidence which is thought to reject the gully hypothesis of contour interpretation of these soundings off the east coast. It may be sufficient to state here that any one who has a conviction of the existence of these gullies need only return to the original data and attempt to contour some portion of the deep outer slopes bearing in mind that unavoidable errors of observation increase with depth.

A SUBMARINE ORIGIN OF THE CANYONS

The recent hypotheses which attempt to explain submarine canyons as formed without emergence include in order of their appearance: R. A. Daly's muddy density currents, D. W. Johnson's artesian springs, and W. H. Bucher's tsunamic sea waves (also called tidal waves or seismic sea waves). In defending these hypotheses the advantage of the gully concept provided by the Veatch-Smith maps is very evident, since none of these processes could account for huge canyons. All these authors have referred to canyons like those off the California coast as a different phenomenon from the submarine valleys which they are trying to explain. They all imply that submarine valleys in general are of the nature of the Veatch-Smith gullies.

---

[1] Contributions from the Scripps Institution of Oceanography, New Series, No. 214.

[2] Special Paper 7, Geological Society of America, 1939.

[3] D. W. Johnson, "The Origin of Submarine Canyons," Columbia University Press, 1939; R. A. Daly, "The Floor of the Ocean," Univ. of North Carolina Press, 1942.

[4] W. H. Bucher, *Bull. Geol. Soc. Amer.*, Vol. 51, pp. 489–512.

Daly's idea that muddy currents moved down the ocean slopes during glacial stages might conceivably be used to explain small gullies cut into a muddy slope, but even for this explanation Daly had to draw on the now discredited idea that the outer continental shelves are or were great mud banks. Bucher's tsunamis (tidal waves) must set up occasional strong currents on the ocean floor, but it would be amazing if these rare manifestations could have cut more than small valleys into the ocean slopes. Furthermore, the distribution of submarine canyons shows no relationship to the areas where these waves occur. Also the waves are of a nature which should produce erosion on projections rather than in valley-like indentations. Johnson's artesian springs require high land along the coast with water-bearing layers dipping seaward and extending under the shelf and outcropping on the outer slopes. Even under these ideal and rare conditions, excavations on the slope by the artesian springs could produce only small valleys, which should have many basin depressions along their length. Even the fanciful Veatch-Smith contours show nothing of this sort. For further objections to these hypotheses the reader may refer either to the Johnson or Daly book which are most successful in discounting the other's hypothesis or to the writer's discussion of the subject in which an attempt was made to give facts favorable and unfavorable to each hypothesis.[5]

Leaving Hamlet out of the Play

If all this attempt to explain submarine valleys is dealing with a purely fictitious concept, the situation would appear to approach the ridiculous. Are the typical submarine valleys of the world of the order of these hypothetical east coast gullies or are they comparable to the well-known California rock-walled canyons? All the available evidence suggests that the latter is the case. The Coast and Geodetic Survey charts provide abundant evidence of the existence of canyons thousands of feet deep and extending many miles into the outer edge of the continental shelf. H. C. Stetson's well-known investigations have shown that many of the sea canyons have rocky walls. Most of the information regarding other submarine valleys comes from the charts of the world. All available charts have been studied by the writer and the soundings indicate clearly that the great majority of the known submarine valleys are large canyons, that is, canyons comparable in dimensions with those which cut great mountain walls. Furthermore, the bottom notations reveal that rock is present on the canyon sides in numerous places. These statements may be easily verified by examination of the charts from the various coasts of the world.

Is it reasonable to present a hypothesis which disregards such great submarine canyons as the huge Hudson Canyon which can be traced for miles off New York, the canyon off the Congo, which is a hundred and twenty miles long and extends 18 miles into the coast in the Congo estuary, the huge Fosse de Cap Breton off southwestern France, the equally large Canal de Nazare off the Portuguese coast which appears to be cut in granite, the canyon off the Indus which crosses a 60-mile shelf off the Indus River or the rock-walled canyons off Ceylon, to mention a few all off relatively stable coasts? If we consider all these great canyons as well as all the canyons off unstable coasts as exceptional, just what will we have left? We are not only excluding Hamlet from the stage, but all the other actors.

River Erosion

Despite the enthusiastic abandonment of the river erosion hypothesis by these recent writers the facts continue to favor the idea. All the detailed surveys of the submarine canyons have revealed distinctly river valley characteristics.[6] Characteristically these canyons the world over are V-shaped, steep rock-walled, winding valleys with branching tributaries. A very large per cent. are located off river mouths and some of them are obviously submarine continuations of land canyons. The explored canyons off California contain numerous rounded pebbles even at depths as great as one mile below sea level. Many other observations indicate the submergence of the land margins. The case may not be rigidly established, but it is substantial and should not be thrown aside just because it presents a difficulty in the path of certain preconceived hypotheses. It is to be hoped that if there are future suggestions of causes of submarine canyons, they will be evolved after a careful study of the facts or preferably after field investigation of the canyons.

---

[5] Special Paper No. 31, Geological Society of America, 1941.

[6] Charts of many are available in Special Paper 31, Geological Society of America.

OBITUARY

ALBRO D. MORRILL

1854–1943

Albro D. Morrill, emeritus professor of biology in Hamilton College, died on June 8, 1943, following an attack of apoplexy. He was born in Northfield, N. H., on August 29, 1854. As a boy, he spent much time working in his father's nursery. It was here, while budding fruit trees, that he first became interested in biology.

Professor Morrill received his bachelor of science degree from Dartmouth College in 1876 and his master of science degree from Dartmouth three years later. Belmont College gave him an honorary master of arts degree in 1886, and in 1926 he was honored with a doctor of science degree by Colgate University.

He began his teaching career in 1878 as science teacher in an academy at Lewiston, Pa. In 1883 he accepted a professorship at Belmont College and in 1888 he went to Ohio University as professor of geology and biology. He came to Hamilton College in 1892 as professor of chemistry and biology, but from 1896 until his retirement in 1928 he devoted himself to biology.

Professor Morrill's greatest professional achievement was the creation and development of the biology department at Hamilton. During the early days of his professorship at Hamilton emphasis was on classical study, yet in his quiet, independent and creative way he got a department of biology going. His first laboratory was in an old dormitory where there was not even running water. Yet, on his retirement in 1928, after thirty-seven years on the Hamilton College faculty, he turned over to his successors one of the best college biological laboratories in the country, an unusually good natural history museum and an excellent library.

At the time of his retirement the hundreds of students who had majored in biology under his instruction established a fund in the interest of an A. D. Morrill Biological Library to which Professor Morrill added his personal collection.

Professor Morrill always retained one characteristic of his New England ancestry: he was sparing in his use of words, yet he was a gifted teacher. He stimulated students to find out things for themselves. In spite of his reserved manner he acquired the true affection of his students, and one of his greatest satisfactions was the feeling that he had contributed to the world of science through the successes of the men who had been students of his during their college years.

He was one of the pioneer research workers in the Marine Biological Laboratory at Woods Hole, Mass., and at the laboratories of the U. S. Bureau of Fisheries at Beaufort, N. C. At the age of fifty, under advice from his physician, he broke with the habit of years, that of spending nine months in his college laboratory and then three at Woods Hole. In the summer of 1904 he accepted the opportunity to join a picked group to be trained by the Bureau of University Travel as leaders of future parties of European travelers. For the next ten years he spent his summers in this work.

Professor Morrill was a fellow of the American Association for the Advancement of Science and a member of the American Society of Naturalists, the American Society of Zoologists, the Boston Society of Natural History and the College Faculty Club. He was associated with the Presbyterian church of Clinton, where he taught a Sunday-school class for many years.

On December 23, 1879, he married Miss Lena E. Carver, of Binghamton, N. Y., who died in 1934. His sister, Catharine Morrill, who has made her home with him, survives.

Walter N. Hess

ELIZABETH TOWAR PLATT

Elizabeth Towar Platt, librarian of the American Geographical Society, bibliographer, informed geographical student, respected editor, died in New York City on May 22 in her forty-fourth year. Although her professional life was comparatively brief, her contributions to geography were many and, fortunately, of an enduring character.

Elizabeth Platt was born on February 25, 1900, into a family prominent in the anthracite coal industry in Hazleton, Pennsylvania. Trained as a librarian at Columbia University, her appointment to the staff of the American Geographical Society in 1920 gave definition to her career. Early sensing the importance of securing a broad geographical background, she supplemented her formal library training with studies in geology and geography at Columbia, leading to the bachelor's degree in 1930 and the master's degree two years later. Thus a fortunate combination of native abilities and training, strengthened by practical experience, bore fruit in the adaptation of library methods to the requirements of geographical research. Advanced to the position of assistant librarian in 1925, Miss Platt gradually assumed administrative charge, under the general direction of Dr. John K. Wright, and became largely responsible for book selections and cataloguing. Her promotion in 1937 to the position of librarian was a fitting sequel to these events.

The expansion of the society's library from 80,000 volumes in 1925 to nearly 120,000 in the present year provides an impressive measure of Miss Platt's mounting responsibilities. More than this, the collections were carefully listed and organized into the cognate fields provided for in the Research Catalogue, which was established in 1923 and improved and extended under Miss Platt's direction. Consultants seeking aid beyond that offered by the Research Catalogue would find Miss Platt a ready and reliable source of suggestion and advice. Her ability in assembling materials on the comprehensive problems often confronting geographical investigators is well remembered by the many, from this country and abroad, who have studied in the society's library. Warm acknowledgments to the librarian's unstinted aid appear in the prefaces and footnotes of numerous volumes.

During the past decade, Miss Platt's services to research workers extended far beyond the confines of the library. *Current Geographical Publications,* issued monthly except during the summer, was launched in 1938 entirely as a result of her enterprise and industry. True to its title, this bibliography lists significant literature—the word is used in the broad sense—under the categories of the Research Catalogue. Valued by investigators in geography and allied fields, *Current Geographical Publications* is now the only publication of its kind in existence. In addition, Miss Platt prepared the society's annual contributions to *Bibliographie Géographique Internationale* from 1923 to its suspension of publication after 1938. The material included in the *Bibliographie* embraced all geographical works published in the United States, covering the field of geography as a whole, and the geography of Latin America, and its preparation involved a large amount of collation and editing during two or three months each year. Only a small group of colleagues knew of Miss Platt's contributions to the distinguished French bibliography; fewer still are aware that many unsigned notes and reviews in the *Geographical Review* and the *Handbook of Latin American Studies* were likewise hers. She was a member of the advisory group which helped found *Social Science Abstracts,* and was a regular contributor to the *American Year Book.* She also founded and assembled an extensive photographic collection.

In keeping with Elizabeth Platt's interests and skills were two other tasks of a high order—one unfinished, the other completed just before her death. Since about the year 1930, she had been systematically accumulating references to geographical and cartographic bibliographies, an extensive compilation which was to have been used this summer, in collaboration with Dr. Wright, in preparing a new edition of "Aids to Geographical Research," originally issued by the society in 1923. It is encouraging to learn that this revision will be carried through by its senior author and that, in its new and enlarged form, an additional monument to Miss Platt's work will be available. During the closing year of her life, Miss Platt edited "Mirror for Americans: Likeness of the Eastern Seaboard, 1810," forming Special Publication 27 of the society. This volume, involving the use of sources to a new purpose, presented an editorial challenge to one versed, as was Miss Platt, in the handling and interpretation of geographical and near-geographical literature. The editorial work was performed with enthusiasm and devotion to the difficult task at hand. The memorialist, who is also the author of the book, may be permitted to record that Miss Platt prepared the citations in the bibliography and that a large proportion of the notes, occupying nearly forty closely printed pages, received the benefit of her expert knowledge. The format, typography and many of the illustrations were suggested by her, and throughout are numerous evidences of her good taste and discrimination and of her love of books. It is a matter of deep regret that, so closely did Miss Platt's death follow the appearance of the printed volume, she was unable to see the results.

Miss Platt was a member of many societies representing the two fields of her chief intellectual interests, bibliography and geography, and enjoyed the distinction of being a representative to the Division of Geology and Geography of the National Research Council. She was a member of the American Library Association, the Special Libraries Association, the Bibliographical Society of America, the New York Library Club; and at one time served as treasurer of the New York Group of the Society of Woman Geographers. She was elected this year to the Association of American Geographers one of whose members, upon learning of her unexpected death, framed the combined sentiment in saying, "We could not afford to lose her."

RALPH H. BROWN

UNIVERSITY OF MINNESOTA

RECENT DEATHS

DR. FREDERICK J. TAUSSIG, professor of clinical obstetrics at Washington University Medical School, St. Louis, died on August 21 in his seventy-first year.

PHILIP N. MOULTHROP, assistant in charge of mammalogy at the Cleveland Museum of Natural History, died on August 21 at the age of thirty-one years.

SCIENTIFIC EVENTS

THE NATIONAL ACADEMY OF PEIPING

A REPORT of the National Academy of Peiping covering the years 1937–42 has been issued by the Kunming Office of the academy and is summarized in *Nature*. On the outbreak of the present war with Japan, Peiping was immediately taken over by the invader, and the academy, which at its foundation in 1929 consisted of nine separate research institutes with a staff of more than two hundred, succeeded in transferring part of the books and equipment of each of its institutes to the south; within a few months most of its work was resumed at Kunming, Yunnan, with a staff now consisting of 120 members. In addition to Chinese Government grants amounting to $620,000, grants are received from the Sino-American, Sino-British and Sino-French Foundation Funds. The Institute of Physics has been increasingly concerned with problems of industry and national defense. A laboratory for spectroscopy has been established to meet the needs of the new metallurgical industry, and the institute has also standardized more than a thousand radio transmitters with its own quartz oscillators. Its other efforts have been confined mainly to the development of applied optics and geophysical prospecting. The Institute of Radium consists of laboratories for chemistry and radioactivity, in which many Chinese minerals have been examined, and for x-rays, where the work has been mainly on crystal analysis and x-ray studies of alloys of tungsten and antimony.

In the Institute of Chemistry, work has been carried out on the extraction of dyes from local plants and their application to textiles, the preparation and small-scale manufacture of medicinals from local raw materials, the recovery of used engine oils, replacement of Diesel oil by vegetable oil and preparation of a substitute for petrol from molasses and sawdust, analysis of water supplies and extraction of potash from different types of ashes. The Institute of Materia Medica has concentrated on investigations of Chinese drugs, such as Chinese ephedra. The active principles have been isolated, and their properties and pharmacological action studied. Some materials, such as ephedrin and vitamin B_1, have been prepared on a commercial scale for clinical use. The Institute of Physiology has extended its investigations on the physiological effects of various Chinese drugs to investigations on the nutrition values of the foodstuffs used by inhabitants of the southwest of China, and the treatment of chicken cholera with sulfanilamide. The Institute of Zoology, besides work on the fauna of Yunnan, has made systematic studies of the principal fresh-water fauna of Yunnan, particularly the fishes of the inland lakes, their diseases and enemies. The Institute of Botany has commenced investigations on economic botany, in addition to those on agriculture and forestry already in progress, and a special survey of the plant life of northwest China has been planned and organized. The Institute of Geology is mainly occupied with the detailed mapping of mineral deposits.

THE UNIVERSITY OF LONDON

THE report of the acting principal of the University of London, Harold Claughton, on the work of the University of London during the year 1942–3, according to *The British Medical Journal*, mentions that several schools have decided that, provided certain essential repairs to their London buildings can be undertaken, they should return to London. Among these are King's College, which hopes to bring its remaining faculties back from Bristol, following the return, which has already taken place, of the medical students from Birmingham; the London School of Medicine for Women, which is bringing its preclinical students back from Exeter; the London Hospital Medical College, whose preclinical students are returning from Cambridge; the Middlesex Hospital Medical School, whose preclinical students have returned from Leeds; and the whole Medical School of University College Hospital, because the sector hospital in which teaching has so far been conducted is now put to other uses. Certain schools have suffered such heavy war damage that it is most unlikely that they will be able to return until after the war; among these is St. Bartholomew's Hospital Medical College.

The section of the report on teaching and research says that in the case of medicine, to meet the urgent demand for doctors for the armed forces, the time required to be spent on the full medical course (but not the course itself) has been shortened and additional examinations have been held.

At the London Hospital Medical College Professor A. W. M. Ellis has resigned from the chair of medicine on his appointment as Regius professor of medicine at the University of Oxford. At the Middlesex Hospital Medical School Dr. B. W. Windeyer has been appointed as the first occupant of the chair of radiology, which, though instituted in 1920, had never been filled. At University College Hospital Medical School Professor C. R. Harington has resigned from the chair of chemical pathology and his post as director of the Graham Research Laboratories on being appointed director of the National Institute of Medical Research. At the Royal Cancer Hospital Dr. G. A. R. Kon has been appointed to the chair of chemistry.

THE AMERICAN ASSOCIATION OF CEREAL CHEMISTS AND THE KILGORE BILL

THE Executive Committee of the American Association of Cereal Chemists has unanimously endorsed the following resolution:

WHEREAS, it appears that enactment of the Kilgore-Patman Bill S-702 HR 2100 for the establishment of an Office of Scientific and Technical Mobilization would confuse the war effort and might develop in peace time into a bureaucracy that would impede scientific and technical progress and

WHEREAS, the Executive Committee of the American Association of Cereal Chemists after careful consideration of the cooperation now existing among scientific men in the cereal industries in their joint efforts to aid in the prosecution of the war and with due regard for the possible disturbing effect on this legislation upon the war effort and future technical progress of the nation, therefore be it

Resolved, that this committee representing an association which includes in its membership chemists from most of the cereal laboratories of the United States express its general opposition to this proposed legislation and be it further

Resolved, that all cereal chemists be urged to communicate their objections to this proposal to their Congressmen.

VISUAL INSTRUCTION IN MICROBIOLOGY

ABOUT a year ago the Society of American Bacteriologists appointed a Committee on Materials for Visual Instruction in Microbiology, under the chairmanship of Dr. Harry E. Morton, of the School of Medicine of the University of Pennsylvania, to investigate materials on bacteria, rickettsiae, viruses, fungi and animal parasites (SCIENCE, Vol. 96, No. 2494, Suppl. p. 12). It was believed that such materials would be very helpful in the wartime teaching of these subjects. The committee has concerned itself during the first year with the investigation of motion picture films on these subjects. About 80 films have been reviewed. Anybody interested may obtain a list of the titles of the films which have been reviewed. Individuals may obtain abstracts of any films on the list in which they are interested. The abstracts give such pertinent information as date of production of the film, author, producer, type of film, *i.e.*, 16 or 35 mm, silent or sound, colored or black and white, length, name and address of the distributor and under what conditions the films are obtainable. Many of the films are available from various distributors by paying the transportation charges, other films are available by paying a small rental fee. In addition the abstract contains a résumé of the subject content of the film which is helpful to the user of the film and to students. Because of the large demand for the abstracts the work of the committee had to be made self-sufficient. A policy has been instituted of charging three cents per abstract, with a minimum charge of ten cents, and a special price for quantities of a given abstract when used for teaching purposes.

THE PITTSBURGH MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE 1943 fall meeting of the American Chemical Society will be held at Pittsburgh from September 6 to 10 under the presidency of Dr. Per K. Frolich. There will be no plant trips and no organized entertainment. All the time will be available for technical sessions, conferences and group discussions. There will, however, according to the official announcement, be special symposia, round tables and scientific papers planned to be helpful to chemists and chemical engineers in their war activities. Committees of many war agencies will hold meetings. The Employment Clearing House will aid employers needing chemists and chemical engineers and those men and women who are not at present using their talents to the full.

A number of symposia has been arranged on the following subjects:

The Stephen M. Babcock Memorial Symposium, Ellery H. Harvey, presiding. Thursday morning, September 9.

Technical Library Techniques, Norman C. Hill, presiding. Tuesday morning and afternoon, September 7.

The Research Tools of the Colloid Chemist, W. O. Milligan, presiding. Thursday morning and afternoon, September 9, and Friday morning and afternoon, September 10.

Boron in Agriculture, H. B. Siems, presiding. Monday morning and afternoon, September 6.

Research Management, Francis J. Curtis, presiding. Monday morning and afternoon, September 6.

Molecular Addition Compounds, W. Conard Fernelius, presiding. Monday morning and afternoon, September 6.

Reactions of Solids, Roland Ward, presiding. Tuesday morning, September 7.

Industrial Hygiene, L. F. Warrick, presiding. Monday morning and afternoon, September 6.

Manpower Problems in the Chemical Industry, Albert L. Elder, presiding. Tuesday morning and afternoon, September 7.

Lactic Acid and Its Derived Products, Lee T. Smith, presiding. Thursday morning, September 9.

A number of general papers will be read before the sections of the various divisions. In addition there will be groups of papers on special subjects. These include vitamins, proteins, nutrition, enzymes, hormones, metabolism, paints and varnish, plastics, kinetics and sugar. On Friday morning and afternoon there will be a round-table discussion on pilot-plant design construction and operation presided over by R. E. Burk.

The Pittsburgh section has arranged for an informal "get-together" on Monday evening, September 6. The presidential address of Dr. Frolich will be delivered on Wednesday afternoon. His address is entitled "Petroleum—Past, Present and Future." Colonel Bradley Dewey, of the Office of the Rubber Director, will speak on "The Synthetic Rubber Program—Present and Future"; Colonel Paul P. Logan, Quartermaster Corps, on "Army Food." A subscription dinner will be given at 7: 30 in the evening.

On Wednesday, September 8, in the ballroom of the Hotel William Penn, there will be a continuous showing of industrial motion picture films from 9: 30 to 11: 30 A.M.

The Alien Property Custodian of the United States Government will exhibit some 10,000 copies of vested United States chemical patents and chemical patent applications. Formerly enemy-owned or enemy-controlled, these patents and patent applications are now under the control of the Alien Property Custodian. All, except those exclusively licensed to American firms, are available for use on liberal terms. The Fisher Scientific Company has arranged for an exhibit of its collection of about one hundred and fifty chemical and historical pictures.

AWARDS OF SIGMA XI GRANTS-IN-AID OF RESEARCH

THE following awards have been made in 1943 by the Society of the Sigma Xi:

R. H. Alden, of the University of Tennessee Medical School:
$200 for the purchase of equipment to aid in studies on the implantation of a mammalian egg.

T. T. Chen, of the University of California:
$290 to defray partial cost of special optical equipment for a microscope to aid in studies on the nuclei of malaria parasites.

E. E. Dale, of Union College:
$200 for technical assistance in connection with the study of the genetics and histology of petunia.

E. S. Deevey, Jr., of the Woods Hole Oceanographic Institute:
$150 to be used in the construction of a Wilson borer for studies on the developmental history of lakes.

R. R. Humphrey, of the University of Buffalo:
$150 to provide for part-time assistance in connection with studies on the genetics of sex determination in Amblystoma.

A. T. Miller, Jr., of the Medical School of the University of North Carolina:
$250 for assistance in the purchase of a pump and motor for the operation of a low pressure chamber.

E. H. Myers, of Stanford University:
$350 to be used in the purchase of equipment to aid in a study of the biology of tropical Foraminifera.

C. A. Neuberg, of New York University:
$250 for use in defraying cost of special chemicals and apparatus in connection with investigations on fermentation.

H. H. Nininger, of the American Meteorite Laboratory:
$250 for assistance in the publication of the results on the relation between meteorites and geology.

R. A. Studhalter and W. S. Glock, of the Texas Technological College, Lubbock:
$150 for technical assistance in the continuation of studies on tree rings.

The committee that made the awards consisted of Dr. Harlow Shapley, of the Harvard College Observatory, president of the society; Dr. Hugh S. Taylor, of Princeton University, and Dr. L. C. Dunn, of Columbia University.

SCIENTIFIC NOTES AND NEWS

THE Award of $1,000 in Pure Chemistry of the American Chemical Society, initiated by the late A. C. Langmuir and now provided for by Alpha Chi Sigma, has been awarded for the year 1943 to Kenneth Sanborn Pitzer, of the department of chemistry of the University of California. The prize will be presented to Dr. Pitzer at the annual meeting of the society, which will be held in Pittsburgh from September 6 to 10.

Chemical and Engineering News states that Ronald Q. Smith, chairman of the Hawaiian Section of the American Chemical Society, has been awarded the Legion of Merit by the Commanding General of the Hawaiian Department in recognition of his work in designing and manufacturing emergency gas masks and modified standard masks for small children. The presentation was made at a ceremony on June 24. Major Smith is on leave as an officer of the Pacific Guano and Fertilizer Company, while on active duty with the Chemical Warfare Service.

DR. SAMUEL ADAMS TRUFANT, III, has been presented with the Walter Reed Memorial Award for his thesis entitled "Sylvatic Plague." The award is given by Tulane University to a senior student at the School of Medicine.

NEWLY elected officers of the National Association of Science Writers are: *President*, Robert D. Potter, science editor of *The American Weekly;* and *Secretary-Treasurer*, Captain McDonough, AUS, Office of the Surgeon General of the Army. Committee appointments include Howard Blakeslee, the Associated Press, chairman of the President's Advisory Committee; William Laurence, *The New York Times*, chairman of the War Advisory Committee; Gobind B. Lal, International News Service, chairman of the Program Committee. A special publication committee has been appointed to explore the possibilities of founding an official journal of the association—a magazine designed to bring the advances of science and medicine to a wide layman audience. Serving on the committee with Potter, Laurence and Blakeslee are Waldemar Kaempffert, *The New York Times;* David Dietz, Scripps-Howard Newspapers, and Laurence Salter, the American Medical Association.

DR. WILLIAM WORTH HALE, since 1918 associate professor of pharmacology and assistant dean of the faculty of medicine of Harvard University, retired on August 31. He will continue as assistant dean of the faculty of medicine and chairman of the committee on admissions.

MALCOLM E. CAMPBELL, research manager of the Textile Research Institute, formerly senior cotton technologist of the U. S. Department of Agriculture, has been elected dean of the textile school at North Carolina State College, succeeding Dean Thomas Nelson, who has retired.

DR. HAROLD B. HITCHCOCK has joined the faculty of Middlebury College as assistant professor of biology. He succeeds Dr. Samuel E. Longwell, who retired in May after serving for twenty-four years. Dr. Rex N. Webster has been made chairman of the department. Other appointments include Dr. Charles D. Starr, assistant professor of physical chemistry, and Grant H. Harnest, instructor in biochemistry. John A. MacMorris, since 1934 head of the science department of the Corinth (N. Y.) schools, has been appointed instructor in physics.

J. OSBORN FULLER, instructor in geology at the Ohio State University, has become assistant professor of geology at the University of Virginia.

DR. A. W. HURD, dean of Hamline University, has been appointed director of educational research and service at the Medical College of Virginia.

THE *Journal* of the American Medical Association states that the Schenley Distillers Corporation through its president, Louis Rosenstiel, has made available to the Medical School of Northwestern University a grant for research on penicillin to include the production of the product and its application in cases of disease. A special committee has been established to control this research. Its members include Chester J. Farmer, *chairman,* Dr. Alexander A. Day, Dr. Sumner L. Koch, Dr. Walter S. Priest, Dr. Henry B. Bull, Dr. Guy P. Youmans and Samuel E. Thomason.

DR. DONALD G. MARQUIS has been appointed director of the Office of Psychological Personnel, 2101 Constitution Avenue, Washington 25, D. C., to succeed Dr. Steuart Henderson Britt, who has been commissioned in the Navy. Mrs. Jane D. Morgan has been appointed assistant to the director.

The Experiment Station Record reports that Dr. C. O. Brannen has been appointed director of the Agricultural Experiment Station of the University of Arkansas, as of July 1, and also director of the university bureau of research, set up for the purpose of coordinating all research work in the university. The former director, Dr. W. R. Horlacher, will continue as dean of the College of Agriculture and director of extension.

RESEARCH work at the Florida Agricultural Experiment Station will be materially increased by the recent appointment of three additional staff members as follows: Dr. Cyril L. Comar, formerly research assistant in chemistry at the Michigan State College, has been appointed associate biochemist, to conduct research in animal nutrition; Dr. Henry C. Harris, agronomist with the Delaware Agricultural Experiment Station, has been appointed associate agronomist, to conduct experimental work on pasture grasses, and Dr. Roger W. Bledsoe has been appointed associate agronomist for farm crops research. In addition, Dr. E. M. Andersen, assistant horticulturist, Sub-Tropical Experiment Station, Homestead, has been transferred to the Watermelon and Grape Investigations Laboratory, Leesburg, as associate horticulturist in charge, in the absence of Dr. M. N. Walker, plant pathologist on special work with the Bureau of Plant Industry.

AARON ARNOLD has been appointed head of the Nutritional Laboratory of the Winthrop Chemical Company at Rensselaer, N. Y.

DR. L. F. YNTEMA, professor of chemistry at St. Louis University, since 1930 head of the department of chemistry, has resigned to accept a research position with Fansteel Metallurgical Corporation, North Chicago.

DR. CHARLES S. VENABLE, who has been in charge of the viscose chemical research laboratory of the American Viscose Corporation, has been appointed director of chemical research. F. William Koster, in charge of acetate rayon and vinyon research at the Meadville, Pa., plant of the corporation, has been appointed assistant director, and will be transferred to the plant at Marcus Hook, Pa.

DR. EMMETT R. DUNN, curator of reptiles of the Philadelphia Academy of Natural Sciences, is serving in South America under the Committee for Inter-American Artistic and Intellectual Relations. He has been assigned to the Institute of Natural Sciences, National University, Bogota, Colombia, where he will work on the collections of reptiles and amphibians from the eastern slope of the Andes. He will also collect specimens in the field.

A POSTGRADUATE Assembly on Nutrition in Wartime will be held by the Institute of Medicine of Chicago on Wednesday and Thursday, November 17 and 18. It will be devoted to phases of nutrition that are of particular interest at this time to practicing physicians, dentists, nutritionists and dietitians. There will be no fees of any kind and all members of these professions in Chicago and the Midwest are invited to register. The assembly will present five addresses on each of two mornings and on one afternoon; six panel discussions on the afternoon of the second day, and a "Nutrition Information, Please" program on the first evening. The First William Hamlin Wilder Memorial Lecture will be given on the evening of the second day by Dr. Russell M. Wilder, chief of the Civilian Food Requirements Branch, War Food Administration, Washington.

A BILL signed by the Governor of Alabama appropriates, to establish the Medical College of Alabama, a million dollars for land, buildings and equipment and $366,760 for each of the fiscal years ending September 30, 1944, and September 30, 1945. A building commission to select a site for the school, which will be conducted as a part of the University of Alabama, will be appointed. The bill authorizes the board of trustees of the university to establish a scholarship for each county in the state in the amount of $400 a year for the benefit of one resident of each county, payable from the annual state appropriation to the School of Medicine.

DRAKE UNIVERSITY, Des Moines, has announced receipt of a gift of $200,000 to build and equip after the war a new science building to be known as "Harvey Ingham Science Hall." The building is the gift of the Gardner Cowles Foundation, and the equipment will be given by the Register and Tribune Corporation. Mr. Ingham, in whose honor the new science hall is to be named, became editor emeritus of the Register and Tribune newspapers last January after serving as editor for forty years. The present Science Hall houses (with the exception of physics and astronomy) the science departments of the university and the College of Pharmacy.

THE Research Laboratory of the General Electric Company, Schenectady, N. Y., announces that 100,000,000-volt x-rays were produced on August 21 for the first time in the history of science. They were obtained from the large induction electron accelerator recently completed. The characteristics of this new type of radiation will be published as fast as they can be determined. The first few observations suffice to show, it is said, that these characteristics differ radically from those with which physicists are familiar.

THE Connecticut Agricultural Experiment Station at New Haven will hold an "Open House" on the station grounds on September 8. Departing from its traditional Field Day at the Mount Carmel farm, the station is this year setting aside half a day for the public to visit the station proper with its four laboratory buildings and six acres of ground. Open house will begin at 1 : 30 P.M. with a brief welcome by Director William L. Slate and a talk on "Plants and People" by Montague Free, horticulturist of the Brooklyn Botanic Garden. Following the program, visitors will have an opportunity to see the laboratories and greenhouses at work. Staff members will be on hand to explain the work in progress and answer questions on farm and garden subjects. Picnic tables and coffee will be available for early arrivals who bring box lunches. Because of the war limitation, no food will be served. To help to satisfy interest in home vegetable gardening, the "Victory Garden Clinic" will be provided. To the clinic, amateurs are invited to bring problems on soil, diseases and insect pests and any other phases of vegetable or flower gardening. The field work of the staff will be illustrated by moving pictures of forestry and mosquito control and by kodachrome slides of the Mount Carmel experimental grounds and the Tobacco Substation at Windsor. A number of exhibits, including the wood-burning unit for household furnaces, Japanese beetle control and the development of hybrid corn and squash, will be on view.

DISCUSSION

PREVENTION OF ORAL LESIONS IN B_1 AVITAMINOTIC DOGS[1]

IN the course of studies on shock induced by hemorrhage,[2] we have had occasion to produce avitaminosis B_1 in dogs. This has been done in two ways: first by the feeding of the diet suggested by Goodsell[3] which contains casein, sucrose, cottonseed oil, agar and cod liver oil, with autoclaved brewer's yeast to supply the other B complex vitamins, and second, by supplying the diet of Schaefer, McKibbin and Elvehjem,[4] in which, instead of brewer's yeast, the dogs were given riboflavin, nicotinic acid, pantothenic acid, pyridoxine and choline, in adequate amounts by stomach tube twice weekly. Many of the animals in both groups developed necrotic erosions beginning around the teeth and sometimes becoming so severe as to extend almost entirely around the lower jaw. Most of these lesions showed a thin mucopurulent discharge and a mildly fetid odor. We had supposed that these lesions, when they occurred in animals on the diet of Goodsell, were produced by the failure of the animals to eat the B complex vitamins contained in the autoclaved yeast, since it is well known that B_1 avitaminotic animals have little appetite. However, when, with the diet of Schaefer *et al.*, B complex vitamins were supplied by stomach tube, the lesions still occurred.

---

[1] The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Vanderbilt University.

[2] W. M. Govier, *Jour. Pharmac. and Exper. Therap.*, 77: 40, 1943.

[3] J. Goodsell, *Am. Jour. Physiol.*, 134: 119, 1941.

[4] A. E. Schaefer, J. M. McKibbin and C. A. Elvehjem, *Jour. Biol. Chem.*, 144: 679, 1942.

Although dogs normally synthesize their own vitamin C, the work of Sure *et al.*[5] suggested to us that perhaps, under the experimental conditions named above, they were unable to do so. These workers showed that various members of the vitamin B complex, including thiamin, were necessary for synthesis of vitamin C in the rat, another animal normally synthesizing its own ascorbic acid.

On this basis all the dogs were given 10 mg of ascorbic acid twice weekly with the other vitamins by stomach tube. Those animals showing the oral lesions promptly healed, and no more lesions appeared in the other dogs.

WM. M. GOVIER
MARGARET E. GREIG

DEPARTMENT OF PHARMACOLOGY,
SCHOOL OF MEDICINE,
VANDERBILT UNIVERSITY

THE GROWTH OF AN ICE SHEET

A REVIEW

IN a convocation address at Chicago Professor Flint announced a new theory of the growth of the ice sheet that had spread itself over most of North America that lies to the north of the Ohio and Missouri rivers.

This theory has now been published *in extenso* in both of the two most authoritative geological journals,[1] and, four months later, in the most authoritative and widely circulated journal of geography.[2] It is thus to have a publicity altogether exceptional for a technical discussion.

After picturing the development of an ice sheet from mountain glaciers in the highlands of Labrador, Flint proceeds to explain the manner of its expansion until its western boundaries had reached to what is now Wisconsin and Illinois. This had been brought about, claims Flint, by a process which is simplicity itself. The migrating low pressure areas of the atmosphere (cyclones) were presumably then as now charged with moisture and moving in an east northeasterly direction. They arrived at the western margin of the ice sheet where with the greatest of ease they advanced over the glacier to drop their moisture as snow a good part of the way in to the boss of the central ice dome. By processes generally understood for mountain glaciers this snow was transformed into glacier ice and by internal glacier flow it expanded the glacier boundaries westward and southward into the mid-Mississippi valley.

This theory thus takes full account of the studies of mountain glaciers made in the Alps by Agassiz during the early 1840's, but it ignores completely what has since been learned, particularly during the last quarter century, from studies of the existing continental glaciers of Greenland and the Antarctic.

The glacial anticyclone, a system of fierce outward-blowing storm winds which is fixed in position over a continental glacier, renders the cyclones powerless to invade it save in a waning stage of glaciation. The glacial anticyclone is nowhere discussed in Flint's theory and the extensive literature of the subject is not included in his three-page bibliography.

Those who read the exposition of Flint's amazing theory should be advised that studies made in Greenland by the German and American expeditions during the last decade have traced the paths of the cyclones which approach the glacier. These studies have shown that the cyclones are powerless to advance over the glacier more than a few tens of miles, and then only during the brief summer season and in south Greenland alone. As the cyclones approach the glacier they are shunted northward along its border and pass up Davis Strait and Baffin Bay. Where they impinge upon the glacier they deposit their moisture, not as snow to nourish it, but as rain to bring about its wastage. In fact, it now appears that this is the principal way in which the dissolution of an ice sheet is accomplished.

Of course during an advancing hemicycle of glaciation when ice sheets were growing, the vigor of the glacial anticyclone must have been much greater and cyclones, instead of being shunted away along the glacier margin, must have been repelled farther out during the near approach. This is the period to which Flint's theory applies.

WM. H. HOBBS

ANN ARBOR, MICHIGAN

---

[5] B. Sure, R. M. Theis and R. T. Harrelson, *Jour. Biol. Chem.*, 129: 245, 1939.

[1] Richard Foster Flint, "Progress and Problems in the North American Pleistocene," *Journal of Geology*, 50: 575–578, Aug.–Sept., 1942. "Growth of North American Ice Sheet during the Wisconsin Age," *Bulletin of the Geological Society of America*, 54: 325–362, March 1, 1943. 1 plate, 5 figures, 3 pages of bibliography.

[2] Richard Foster Flint, *The Geographical Review*, 33: 3, 479–481, July, 1943.

CURTAILMENT OF MILITARY PSYCHOLOGY IN GERMANY

In its October 15, 1942, issue, which was only recently received in this country, the Swiss medical review *Praxis* reports the following: "The psychological testing service of the German armed forces has been quite considerably curtailed during the course of this year [that is after the first Russian winter], first in the air force (*Luftwaffe*), then in the army. Up to this time the service was charged with essential tasks of aptitude testing for the selection for special branches of the armed forces and for purposes of promotion."[1]

This report of a sharp curtailment of German military psychology comes as a surprise in view of the knowledge of the importance that it had gained at one time.[2,3] Before the war, 200 military psychologists were working in many testing stations all over Germany.

While the reasons for the curtailment are not given, two explanations suggest themselves: (1) the results of German military psychology were unsatisfactory; (2) its procedures proved themselves impractical under wartime conditions.

It does not seem likely that the first explanation should be correct. German military psychology, which was first installed during the first World War for the selection of automobile drivers, was resumed in 1926 and had since then undergone a steady orderly growth up to the present war. This period of 13 years should have given ample opportunity to test the intrinsic value of the testing service, and if continuous expansion was considered warranted, one must conclude that the results were satisfactory.

As to the second explanation, there seems to be some evidence that it is probably the right one. It is the purpose of this note to discuss that evidence.

German military psychologists were not satisfied with the method of standardized group tests as the basic procedure. They wanted to learn more about the testee than his numerical score on a test. What they wanted was a true character portrait of the testee. This was accomplished by the clinical approach. A testee was studied by a group of psychologists, usually six, for two entire days and in many, partly very realistic, test situations. The psychologists' ratings of the testee in these situations were checked with one another, and from the consensus of the ratings a report about the testee was prepared.

While the method was good, it was very time-consuming and required a relatively large staff of highly trained psychological personnel. Before the war only 100,000 men a year could be handled in this way. The selection procedure was always limited to officer candidates, pilots and specialists. The German military psychologists had been aware of the cumbersomeness of their method. In 1940, for example, a new test item was suggested to replace two previous items of the total procedure. The new item would reduce the amount of necessary testing equipment and represent a considerable saving in time. Whereas the old items required 11½ hours of the psychologists' time for the testing and appraising of 16 men, the new item would reduce this requirement to 5 hours.[4]

Eight months after the invasion of Poland, in May, 1940, a shortage of military psychologists in Germany was reported.[5] Particularly in the air force (*Luftwaffe*) an extraordinary demand for psychologists was anticipated in the near future. It seems that it was difficult to meet this demand, because the following year the training of applied (military) psychologists was expanded. In April, 1941, a new academic degree in psychology, *Diplom-Psychologe*, was created. This degree for applied psychologists has lower requirements than the Ph.D. in psychology, up to that time the only German degree in psychology and one of the qualifications for the military psychologist. The announcement of the new degree in the Spanish journal where we saw it began as follows: "Needs of the state, the Army, and business with regard to psychology have demanded in Germany a broader basis for the training of professional psychologists."[6]

In the light of the recent report of curtailment, it would appear that attempts to procure an adequate number of military psychologists failed. This failure—probably largely due to the high training requirements of the method, the new degree notwithstanding—together with the cumbersomeness of the method, is likely to have led to the final decision of drastic curtailment. If the psychological testing service could not be geared to real wartime demands, curtailment was the only alternative since military procedures must be uniform. It is worth noting that the earlier reported shortage of personnel was greatest among *Luftwaffe* psychologists and that it was subsequently the *Luftwaffe* where psychology was first curtailed.

German military psychology considered the clinical approach as basic. American military psychology, resumed from the first World War in 1940, considered the clinical approach as impractical for a program of Army dimensions and concentrated on standardized tests, although the tests "are always used in conjunction with ratings made by trained interviewers, commanding officers under whom the man is serving, or, in the case of officer candidates, special boards of selection."[7] The curtailment of Germany military psychology in the emergency seems to support the judgment of the American military psychologists.

---

[1] Anon. *Praxis*, 31, 796, 1942.

[2] H. L. Ansbacher, *Psychol. Bull.*, 38, 370–392, 1941.

[3] L. Farago and L. F. Gittler, Editors. "German Psychological Warfare: Survey and Bibliography." New York: Committee for National Morale, 1941. Pp. 155.

[4] E. Läpple, *Zeits. angew. Psychol.*, 60, 1–63, 1940.

[5] M. Simoneit, *Soldatentum*, May, 1940.

[6] Anon. The title of "Diplome Psychologist" in Germany. *Psicotecnia*, 2, 218, 1941.

H. L. ANSBACHER

BROWN UNIVERSITY

TRANSLITERATION OF ENGLISH NAMES IN RUSSIAN

IF the transliteration of Russian names into English is a mess, that of English (and other) names into Russian is doubly so. The Russian alphabet, with all other Slavic alphabets except the Polish, has no *w*, which is of little consequence, its place being taken by *v* (as it is, more or less, in the pronunciation of many English words); but for some strange reason the Russians in general do not transliterate the *w* in English names by *v* (though they do so in various German words), but by *u*. Thus Wendell Willkie is "Uendel Uilki," New York is "Niu Iork," Shaw is "So," etc. But this is not all. For some unknown reason the Russian, alone among the Slavic and other European languages, has no *h*, though the sound is present in the Ukrainian and other Russian dialects. Thus Houston, for instance, would be given as "Giustn," Ohio as "Ogio," Hall as "Gol," etc. There is also no *th*, it being replaced by *f*, so that Thomas is "Foma," etc. An effort furthermore is to write foreign names phonetically, which involves further corruptions.

It is plain that to science all this will be of serious and growing disadvantage, as it must be of much impediment to foreigners learning Russian, as well as to Russian youth who learn foreign languages.

The remedy, at least for scientific publications and catalogues, would seem to be fairly simple—the printing by the Russians of all foreign names as they are and in italics; and the general adoption of the letter *h*. The all-powerful Academy of Sciences of the U. S. S. R. could readily effect these changes and they would be very much to its credit.

The Russian alphabet, as is well known, was taken, with orthodox Christianity, from Byzantium, and is essentially the Greek (Ionian) alphabet; but the Greek had both the sound of *h* and its alphabetic representation. The Greek too had (and has) a special letter for *th*.

ALEŠ HRDLIČKA

SMITHSONIAN INSTITUTION

ARTHUR WILLIS GOODSPEED

IN his excellent obituary of Arthur Willis Goodspeed,[1] Horace C. Richards pays tribute to Goodspeed's important pioneer work with x-rays. It is noteworthy that Goodspeed's profound interest in the physical properties of x-rays and in their practical applications was probably due to the fact that he *almost* discovered the phenomenon himself six years before Röntgen. This incident is described in my biography of Wilhelm Conrad Röntgen,[2] from which I quote:

> Goodspeed and a friend by the name of W. N. Jennings were photographing electric sparks and brush discharges on the evening of February 22, 1890. After some such experiments had been completed, the table was still littered with loaded plate holders and other apparatus when Goodspeed brought out some Crookes tubes and demonstrated them to Jennings. The next day, Jennings reported that when the plates were developed he had found a very curious phenomenon: two round discs superimposed upon the spark tracings on the photographic negative. No one could explain this curious effect, and the plates were put aside with other freak photographs and were forgotten. Six years later, after the discovery of the roentgen rays had been announced, these negatives were unearthed and reexamined. Another exposure was made with the same apparatus and under similar conditions, and the results were the same; that is, two discs with a sharp boundary on one side and a blurred boundary on the other side were visible on the plate. Goodspeed concluded a lecture on roentgen rays at the University of Pennsylvania on February 22, 1896, with the story of his early experiments, and said: "We can claim no merit for the discovery, for no discovery was made. All we ask is that you remember, gentlemen, that six years ago, day for day, the first picture in the world by cathodic rays was taken in the Physical Laboratory of the University of Pennsylvania."

Before publishing this account an inquiry in regard to the authenticity of the reports of this event brought from Goodspeed the following answer:

> PHILADELPHIA, February 15, 1929
>
> . . . The accidental roentgen effect which W. N. Jennings and I produced in 1890 was real and authentic. Because of our laxity in not following the matter up we do not claim any credit whatsoever, but the facts are as stated in such articles as you may have read.

OTTO GLASSER

CLEVELAND CLINIC FOUNDATION

QUOTATION

POOLING RESEARCH

SIR JOHN ANDERSON'S visit to Washington and Ottawa marks further progress in a movement which began long before the United States entered the war and which has already yielded fruitful results. The immediate object is to set up a committee of scientists to act as a clearing house for information on scientific research. The committee would be formed, to begin with, by the Governments of Great Britain, the United States and Canada; but it is hoped that in due course the participation of other Governments will be secured and that the committee's work will be extended to deal with the needs of peace as well as with those of war. So far as the Governments are concerned the interchange of information has been as complete as the cooperation in the field. Even at a time when it seemed unlikely that the United States would participate in the actual fighting, the information acquired by the British forces and tested by experience in war was freely communicated to the American authorities and proved invaluable when the United States became an active ally. As the event showed, British science, in aviation, in the use of radio, in the manufacture of explosives and in many other matters, was well ahead of German, although for long years all the efforts of German scientists, like those of every other profession in Germany, had been concentrated on preparation for war.

---

[7] The Staff, Personnel Research Section, Classification and Replacement Branch, The Adjutant General's Office, SCIENCE, 97, 473–478, 1943.

[1] SCIENCE, 98: 125, August 6, 1943.

[2] Springfield, Ill., Charles C Thomas, 1934.

This mutual Anglo-American aid has not been confined to Government agencies. In 1940, at the invitation of President Roosevelt, a British scientific mission under Sir Henry Tizard visited the United States and discussed ways and means of sharing scientific and technical information, and active cooperation was established with American men of science. Canada also took a hand, and Professor R. H. Fowler, then working with the National Research Council of Canada, helped to bring Canadian science into the tripartite arrangement. In the spring of 1941 Dr. Conant, the eminent chemist who is president of Harvard University, visited this country to promote the closest possible collaboration between the National Defense Research Association of the United States and the corresponding organizations in Great Britain. Since America came into the war, this intercourse and interchange has become even more intimate. By an agreement of January 1, 1942, each Government undertook at its own cost to obtain from its nationals such information and manufacturing rights as the other Government may require. These arrangements will be facilitated if, as the result of Sir John Anderson's mission, a regular clearing house is established to enable scientists in each country to keep in close touch with what is being done in the others. Such a clearing house, especially when it is extended to embrace the other countries which play a leading part in discovery and invention, will obviously be no less useful in peace than in war.—*The Times*, London, August 11.

SCIENTIFIC BOOKS

GASES AND VAPORS

The Adsorption of Gases and Vapors. Volume I. *Physical Adsorption.* By STEPHEN BRUNAUER. 511 pp. Princeton, N. J.: Princeton University Press. $7.50.

IN the preface to this volume the author states that he had considered two methods of treating his subject. By the first method he would marshall the observations and data gathered by the hundreds of investigators who have studied the adsorptive properties of charcoal, silica gel, metals, oxides and the many other important adsorbents. By the second method he would survey and discuss the attempts that had been made to analyze these observations and data in order to elucidate the nature of the adsorption process. He finally chose the second method, but he adds:

> Had I started the writing of this book a year later, I would doubtless have adopted the more practical approach because of its more direct relation to the needs of the war industry, but on the day of Pearl Harbor the greater part of this book was already written. As it is, it may prove to be useful in the training of scientists and technicians in colleges. Besides, a good practical chemist knows how to put science to use, and so perhaps this book will also find its way eventually into the stream of the industrial production of our nation.

The reader, in spite of Pearl Harbor, will, I think, be glad that the author chose the second alternative. In McBain's "The Sorption of Gases and Vapours by Solids" we already have a lively and stimulating treatment of adsorption from the phenomenological point of view; although a second edition of this eleven-year-old book is now long overdue and much to be desired. On the other hand, there is no up-to-date, thoroughgoing treatise on the theories of adsorption, and this Dr. Brunauer has now provided.

The author has further delimited his field by discussing only *physical* adsorption in this volume, except for the introductory chapters; he expresses the hope that some day he may write a second volume on chemical adsorption, but remarks that this

> . . . must wait until the end of the war. *Inter arma silent musae.* The writing of such a book is a long and time consuming process incompatible with present urgent work connected with the war. There is not much point in writing science, unless we make the world first safe for science.

A brief outline of the contents is as follows:

The introductory chapters present a selection of the important data on adsorption and a discussion of the experimental methods by which these data have been obtained. There follow three scholarly chapters on the various theories of adsorption, the derivation from them of equations for the adsorption isotherm, and the success of these equations in the representation of the observed data. Then come two chapters on the heat of adsorption and two on the surface of the adsorbent. Finally, there is a chapter each on the pore structure of the adsorbent, on the kinetics of adsorption and on mixed adsorption.

The treatment is thorough, up-to-date and discriminating. It is neither tiresome nor encyclopedic, as is so often the case in general treatises of this kind. Only such mathematics is included as is necessary to understand the course of the argument. Best of all, the author does not hesitate to point out the merits or demerits of the theoretical conclusions which he develops, but his comments are restrained and judicial. His style is clear, simple and direct.

The book can be recommended to any one who wishes a broad and thorough survey of our present understanding of the nature of physical adsorption; he will find it both competent and stimulating.

Arthur B. Lamb

TISSUE CULTURE

A Handbook of Plant Tissue Culture. By Philip R. White. Pp. xiv + 277. Lancaster: The Jaques Cattell Press. 71 figs. 1943. $3.75.

Interest in plant tissue culture has been increasing rapidly in recent years. It is significant that we have now advanced to the point where a good handbook on the subject is a necessity. Fortunately a skilled technician in this field has provided an excellent book covering the tissue culture technique briefly but thoroughly. Seldom does one find a complicated subject handled so fully and so succinctly.

Dr. White presents the subject in ten chapters, the first of which by way of introduction stresses the importance of morphogenesis, out of the study of which tissue culture has arisen. He points out clearly the advantages of the tissue culture approach to the problems of the origin of form and function in organized beings.

The second chapter sketches the history of plant tissue culture, in four periods of development. The entire history covers a little more than a century, but most of the progress has been made since 1930. This progress hinged upon the successful development of culture media suitable for the unlimited growth of excised root tips. A fine feature of the historical account is the inclusion of portraits of the major investigators in this field.

The third chapter discusses the material which may be used successfully in tissue cultures, mainly those which are meristematic in character, such as apical meristems, cambial tissues and embryos.

Recognizing the importance of facilities for work, the author devotes the fourth chapter to a detailed description of the kind of laboratory which should be available for such investigations. A detailed floorplan is given, showing a convenient arrangement for laboratory room, transfer room, media room, culture room and office. Even the equipment most useful to the work is detailed, with suggestions and directions for successful manipulation of all equipment.

Several succeeding chapters describe the methods and materials for making synthetic nutrient media—the methods by which cultures may be started; the culture techniques; and the methods of making measurements and recording them for later interpretation. These chapters are all written with the utmost clarity.

The last two chapters turn to the significance of plant tissue culture in the solution of biological problems. These are very stimulative, and will no doubt encourage much more work to be undertaken. Chapter nine, for instance, discusses the relation of tissue culture to the problems of pathology and general physiology; and chapter ten returns to the primary issue, morphogenesis. A bibliography of 457 citations covers collateral fields, as well as plant tissue culture. The work closes with an adequate index.

The book has been admirably planned, and the subject has been handled very skilfully. It is fortunate indeed that the first handbook in this field has been so well done. It should serve for many years as a sufficient guide to students and older investigators interested in tissue cultures. Because of its broad point of view it should find a place in every physiologist's private library.

Charles A. Shull

The University of Chicago

ESSAYS IN BIOLOGY

Essays in Biology. In Honor of Herbert M. Evans. Written by his friends. 687 pp. Berkeley and Los Angeles: University of California Press. 1943. $10.

Forty-eight papers on apparatus, endocrinology, the history of biology, nutrition, physiology, cytology, medicine, growth and experimental biology, together with a complete biography of Evans, are found in this memorial volume. It is issued in commemoration of his sixtieth birthday. Ten of the titles are upon the history of biology, including one by George W. Bartelmez, a translation, with notes, of Purkinje's paper on the "History of the Bird's Egg Previous to Incubation," another by George W. Corner of de Graff's article "On the Female Testes or Ovaries." In addition there are the following titles: "Kidney—Explantation in Relation to Arterial Tension" (8 pp.), Frederick M. Allen; "The Influence of the Endocrine Organs on Intestinal Absorption" (11 pp.), T. L. Althausen; "The Impact of the Introduction of Iron on Medical and Religious Thought" (6 pp.), Walter C. Alvarez; "The Physiology of the Salt-treated Adrenalectomized Animal" (15 pp.), Evelyn Anderson, in which the author concludes that "All these data strongly suggest that the adrenal cortical hormone acts on the mechanisms of the body which require salt"; "The Localization of Lipids in Cytoplasm" (7 pp.), R. R. Bensley; "The Source of Equine Gonadotrophin" (13 pp.), H. H. Cole and Harold Goss; "The Biological Standardization of the Vitamins" (7 pp.), Katharine H. Coward; "The Prevention of Deafness" (5 pp.), S. J. Crowe; "Gene *H* and Testosterone in the Fowl" (9 pp.), C. H. Danforth, in which we discover that "thus far we seem to have gotten no inkling as to the underlying basis for sexual differences in plumage . . . the whole situation may be altered fundamentally by a simple cytological change is apparent in the effects produced by the gene *H*"; "The Influence of Hormones on the Sexual Behavior of Domestic Fowl" (11 pp.), David E. Davis and L. V. Domm; "Pituitary Gonadotrophins" (7 pp.), Heinz L. Frankel-Conrat, Choh Hao Li and Miriam E. Simpson; "Estrogen Assay in the Human" (5 pp.), S. C. Freed; "Functional Interrelation of Cerebral Cortex with Basal Ganglia and Cerebellum" (10 pp.), John F. Fulton; "The Solubility of Proteins and Their Separation from Mixtures with Special Reference to Serum" (11 pp.), Arda Alden Green; "Gonadotrophic Stimulation of the Ovaries of the Adult Rhesus Monkey" (6 pp.), Carl G. Hartman; "The Pathological Clinical and Biochemical Correlation of Tumors of the Testis" (8 pp.), Frank Hinman; "The History of Hypophysial Diabetes" (10 pp.), B. A. Houssay; "The Symballophone: A Double Stethoscope for the Comparison and Lateralization of Sound" (16 pp.), Wm. J. Kerr; "On the Significance of the Forgotten Thermodynamic Theorems of Carnot" (18 pp.), F. O. Koenig; "John Banister and the Pulmonary Circulation" (6 pp.), Stanford V. Larkey and Owsei Temkin; "Comparison of the Conditions under which Estrogens and Carcinogenic Hydrocarbons are Tumorigenic" (19 pp.), Alexander Lipschütz; "Lobulo-alveolar Mammary Growth Induced in Hypophysectomized Rats by Injections of Ovarian and Hypophyseal Hormones" (13 pp.), Wm. R. Lyons; "Pulmonic Interstitial Emphysema and its Sequelae: an Anatomical Interpretation" (32 pp.), Charles C. Macklin and Madge T. Macklin; "Charles Edward Brown-Séquard" (7 pp.), Ralph H. Major; "The Undischarged Ovarian Follicle" (5 pp.), F. H. A. Marshall; "Mechanism of the Descent of the Testicle under the Action of Sex Hormones" (9 pp.), Thales Martins; "A Hemorrhagic State in the Vitamin E-Deficient Fetus of the Rat" (9 pp.), Karl E. Mason; "Relationships of Sodium and Potassium to Carbohydrate Metabolism" (14 pp.), Irvine McQuarrie; "Harvey's Ideas of Embryonic Nutrition" (8 pp.), A. W. Meyer; "Observations on the Pathogenesis of Undulant Fever" (21 pp.), K. F. Meyer; "French Medical Education as a Legacy from the Revolution" (8 pp.), J. M. D. Olmsted; "Cytological Differences between Castration and Thyroidectomy Basophils in the Rat Hypophysis" (12 pp.), J. D. Reese, A. A. Koneff and P. Wainman; "Studies on the Growth of Lymph Nodes, Thymus, and Spleen in the Rat" (9 pp.), William O. Reinhardt; "The Self-Selection of Diets" (6 pp.), Curt P. Richter; "The Relationship of the Anterior Pituitary to the Thyroid and the Adrenal Cortex in the Control of Carbohydrate Metabolism" (19 pp.), Jane A. Russell; "Vesalius and Don Carlos; A Historical Footnote" (8 pp.), John B. deC. M. Saunders; "Impotence as a Result of Witchcraft" (6 pp.), Henry E. Sigerist; "The Coagulation of Blood: Quantitative Viewpoints" (4 pp.), H. P. Smith; "An Experimental Anatomical Study of Sensory Masking" (5 pp.), I. Maclaren Thompson; "The Effect of Progesterone and Lactogenic Hormone upon Prolongation of Pregnancy in the Lactating Mouse" (8 pp.), Kaisa Turpeinen; "Is Increased Capillary Fragility a Sign of Ascorbic Acid Subnutrition?" (8 pp.), Osmo Turpeinen; "The Experimental Production of Pseudohermaphroditism in the Monkey" (25 pp.), G. van Wagenen and James B. Hamilton. "An exogenous androgen can pass through the placenta to induce pseudohermaphroditism in the female young of the monkey." "The Heart in Myxedema" (18 pp.), James J. Waring; "Studies on the Growth of Antlers: II. Seasonal changes in the male reproductive tract of the Virginia deer (*Odocoileus virginianus borealis*); with a discussion of the factors controlling the antler-gonad periodicity" (23 pp.), George B. Wislocki. "Hence, unlike many other secondary sex characters, antler growth is not primarily dependent upon the gonads"; "Sex Differentiation in Heterogeneous Parabiotic Twins (Ambystoma × Triturus)" (19 pp.), Emil Witschi and Harriet M. M. McCurdy, "The growth of ovaries and testes is controlled by gonadal growth substances"; "Ovum, Cycle, and Menstruation" (7 pp.), Bernhard Zondek.

The shortest papers have but four pages; the longest thirty-two. An inspection reveals the fact that if these papers were grouped according to their subject-matter about one half would naturally appear together; the other half would be widely distributed. One may therefore question the advisability of putting out so diversified a group in a single book, admitting at the same time the fine personal tribute thus evidenced. However this may be, it is evident that the material that thus appears is, to a large extent, of such a character as to make quite a general appeal to medical biologists and others.

C. E. McClung

Swarthmore College

SPECIAL ARTICLES

THE EFFECT OF PROPAMIDINE ON BACTERIAL METABOLISM[1]

THE oxidative metabolism of bacteria is not affected by sulfanilamide or its derivatives in concentrations which effectively inhibit their growth. Recently it has been shown[2] that propamidine, a diamidine which is active against a number of protozoan infections, inhibits the growth of bacteria in wounds. It was therefore of interest to determine whether propamidine in concentrations which inhibit growth inhibits the oxidative metabolism of bacteria. *E. coli, Staphylococcus aureus* and *albus* were grown overnight in a medium containing 10 gms of peptone, 10 gms of glucose 3.0 gms of Armour's meat extract and 5 gms of NaCl per liter. The bacteria were centrifuged and washed with water and finally suspended in 0.05 M phosphate buffer pH 7.8. Aliquots were placed in Warburg vessels and the oxygen uptake measured in the presence of added substrates. In the absence of substrates the oxygen uptake was negligible. Nephelometric determinations before and after the experiment showed that no growth occurred during the time the bacteria were shaken in the vessels. This was true even in the presence of meat extract, the oxidation of which tends to proceed in an S-shaped curve. Table 1 illustrates an experiment with *E. coli,* which is typical also of the other bacteria tried.

This experiment shows that the oxidation of constituents of meat extract and peptone is much more sensitive to the drug than that of pyruvic acid or glucose. It is probable that the oxygen uptake in the presence of meat extract or peptone is caused by the oxidation of amino acids, for alanine and asparagine are similarly affected as shown both by the inhibition of the oxygen uptake and ammonia production. The oxidation of glucose and pyruvic acid can be inhibited effectively if the concentration of the drug is increased to M/8000. This concentration is still twenty times smaller than the 0.1 per cent. recommended for application to wounds. As indicated in Table 1, the oxidation of pyruvic acid is more sensitive to the drug than that of glucose. The figures in Table 1 also show that it takes a certain length of time before the inhibition reaches a maximum. This latent period may be attributable to the time necessary for the penetration or activation of the drug because if it is shaken with the bacteria for two hours before the addition of the substrates an immediate inhibition is obtained. At pH 6.7 the inhibition is much less effective than at pH 7.8. Thus at the end of three hours the oxidation of peptone at pH 6.7 is inhibited 29 per cent., at pH 7.8, 68 per cent. The effect of stilbamidine is similar to that of propamidine, except that higher concentrations are necessary to produce equivalent inhibitions.

The oxygen uptake of suspensions of rat kidney and liver is not inhibited by M/8000 propamidine. Addition of various substrates such as succinate, choline, xanthine, d-amino acid and tyramine shows that only the oxidation of the last is inhibited by the drug. The oxygen uptake of rat brain suspensions is, however, inhibited. This is due primarily to the fact that the oxidation of glucose is inhibited 50 per cent. by conceneration of M/30,000. It requires a concentration of M/15,000 to produce a similar effect on the oxidation of pyruvate.

TABLE 1

THE EFFECT OF M/80,000 PROPAMIDINE ON THE OXYGEN UPTAKE OF E. COLI IN THE PRESENCE OF 2.0 MG EACH OF VARIOUS SUBSTRATES, pH 7.8 37°

Time	Oxygen Uptake											
	Peptone			Meat Extract			Pyruvic Acid			Glucose		
	Control	Propamidine	Inhibition	Control	Propamidine	Inhibition	Control	Propamidine	Inhibition	Control	Propamidine	Inhibition
min.	*cmm*	*cmm*	*per cent.*	*cmm*	*cmm*	*per cent.*	*cmm*	*cmm*	*per cent.*	*cmm*	*cmm*	*per cent.*
30	16	16	0	9	9	0	28	27	0	93	98	0
60	29	22	24	22	15	32	73	66	10	191	197	0
90	46	26	44	46	24	48	127	115	10	253	269	0
150	84	32	62	141	45	68	198	178	10	322	345	0
210	121	36	70	219	80	64	222	200	10	380	397	0

SUMMARY

M/80,000 propamidine inhibits the oxidation of the nitrogeneous constituents of the medium in which the bacteria grow. A certain latent period occurs before the inhibition reaches a maximum and the drug is more effective at pH 7.8 than at pH 6.7. As is shown in the accompanying article by Dr. Kohn, this concentration is in the minimal effective range for the inhibition of growth. A latent period and a similar pH effect also are present when growth is inhibited. It is thus possible to conclude that propamidine, unlike sulfanilamide and its derivatives, directly affects the oxidative metabolism of these bacteria.

FREDERICK BERNHEIM

SCHOOL OF MEDICINE,
DUKE UNIVERSITY

---

[1] Dr. D. F. Robertson of Merck and Company very kindly supplied the propamidine and stilbamidine.

[2] W. R. Thrower, F. C. O. Valentine, A. H. McIndoe, A. R. Tilley, G. H. Morley, J. P. Bentley, F. Kohn, M. H. Hall and C. D. Cross, *Lancet,* 144: 133–140, 1943.

THE EFFECT OF PROPAMIDINE ON BACTERIAL GROWTH[1]

THE aromatic diamidines, employed in the treatment of protozoal infections,[2,3] also possess antibacterial action.[4] Propamidine (4:4′-diamidino-diphenoxy propane), used locally in the treatment of wounds, was found[5] to inhibit bacterial growth in complex media and to be uninfluenced by *p*-aminobenzoic acid. These results have been confirmed and extended.

The tests were carried out at 37.7° C., using a standard size of inoculum diluted from an actively growing culture. Ten generations were necessary to produce the degree of turbidity, measured photoelectrically, taken as positive growth. In each trial a series of drug concentrations was tested in order to determine which inhibited the rate of growth by 50 per cent. (*i.e.*, doubled the time taken by the controls to reach the chosen turbidity). Complete inhibition could be obtained by doubling or tripling this concentration.

The effect of peptone was determined with a strain of *E. coli* which grows well in medium SG of inorganic salts and glucose.[6] As shown in Table 1, adding 1 per cent. proteose peptone number 3 (Difco) approximately tripled the required amount of propamidine, whereas in parallel experiments it was found to raise the required sulfathiazole concentration by more than 500 times. Medium PPFG[6] contained 2 per cent. peptone and 0.2 per cent. glucose, added after autoclaving. Changing its pH from 7.0 to 7.7 slightly increased the drug activity. *Staphylococcus aureus* was about as sensitive to the drug as *coli*; raising the pH from 7.0 to 7.7 increased the potency of the drug 3 to 4 times. Stilbamidine was definitely less effective than propamidine. Preliminary testing in urine showed propamidine to be active at less than 4 mg per cent.

TABLE 1

DIAMIDINE CONCENTRATIONS INHIBITING GROWTH BY 50 PER CENT. THE FIGURES IN BRACKETS INDICATE THE NUMBER OF TESTS AVERAGED

Organism	Medium	pH	Propamidine*	Stilbamidine
			mg per cent.	*mg per cent.*
E. coli				
	SG	7.2	0.32 (2)	0.60 (1)
	SG + 1 per cent. P	7.2	0.85 (2)	4.20 (1)
	PPFG	7.7	0.85 (2)	. . .
	PPFG	7.0	1.10 (3)	. . .
Staph. aureus				
	PPFG	7.7	0.43 (3)	12.60 (2)
	PPFG	7.0	1.52 (2)	12.60 (1)

* Dr. Bernheim frequently used M/80,000 or 0.53 mg per cent. to inhibit the respiration of *E. coli*.

In addition, Dr. F. Bernheim and Dr. C. Brindley found the growth of the tubercle bacillus strain H37 to be inhibited about 50 per cent. by 5 mg per cent. propamidine.

The small peptone effect in the case of propamidine suggests that the *in vitro* testing of the drug will be much less difficult than has been the case with the sulfonamides. Also, this fact suggests propamidine to act primarily upon catabolic rather than anabolic systems. This is consistent with Dr. Bernheim's finding that propamidine is a potent inhibitor of cellular oxidations, particularly those involving peptone or meat extracts. As with growth, respiration is inhibited more effectively at alkaline reaction.

Methylene blue has been tested for antagonism in growth experiments. It was without effect in the case of *coli*. In *aureus*, where it is inhibitory, it synergized with propamidine. Sulfathiazole showed synergism with propamidine in *coli* grown in medium SG. In both these cases of synergism, the expected inhibition was doubled.

In *aureus* the inhibition develops gradually during the first two or three divisions (50 to 70 minutes); in *coli* the drug acts more rapidly. In *aureus* the latent period is not shortened by preliminary incubation in medium with the drug at 5° C. for 150 minutes, or 37.7° in buffer with drug. However, incubation at 37.7° C. in buffer plus *glucose* and drug about doubled the inhibition when growth was subsequently initiated by the addition of peptone. This curious result contrasts with the sulfonamides[6] and suggests that the latent period may involve activation of the drug.

HENRY I. KOHN

SCHOOL OF MEDICINE,
DUKE UNIVERSITY

---

[1] Aided by a grant from the Rockefeller Foundation. The drugs were kindly supplied by Merck and Company.

[2] H. King, E. M. Lourie and W. Yorke, *Ann. Trop. Med. and Parasitol.*, 32: 177, 1938.

[3] Numerous papers in *Ann. Trop. Med. and Parasitol.*, 1938–1943.

[4] A. T. Fuller, *Biochem. Jour.*, 36: 548, 1942.

[5] W. R. Thrower, F. C. O. Valentine, A. H. McIndoe, A. R. Tilley, G. H. Morley, J. P. M. Bentley, F. Kohn, M. H. Hall and C. D. Cross, *Lancet*, 144: 133–140, 1943.

[6] H. I. Kohn and J. S. Harris, *Jour. Pharmacol.*, 73: 343, 1941.

THE NATURE OF MYASTHENIA GRAVIS[1]

MYASTHENIA GRAVIS is a slowly progressive but fatal fatiguability and weakness of muscles. Walker's observation[2] that prostigmine, a choline esterase inhibitor, aided patients with myasthenia gravis, suggested that the acetylcholine metabolism was disturbed in such patients. Assuming that this concept has validity, the dominant possibilities concerning myasthenia gravis are: (a) excessive destruction of acetylcholine due to unusually large amounts of choline esterase

---

[1] From the Departments of Medicine (Neurology) and Psychiatry, Cornell University Medical College and the New York Hospital, New York City.

[2] *Proc. Roy. Soc. Med.*, 28: 759, 1935.

(demonstrated to be unlikely by Milhorat[3]); (b) defects in the ability of muscle to utilize acetylcholine (disproven by Lanari[4] and Harvey and collaborators[5,6]); and (c) defects in the synthesis of acetylcholine.

The most plausible hypothesis is that there exists a fundamental defect in the synthesis of acetylcholine in patients with myasthenia gravis. Dr. Otto Loewi suggested that such synthesis be investigated. We are immeasurably indebted to Dr. Loewi for his enthusiastic interest in the development of the problem and for his valuable advice on technique.

Method: The acetylcholine synthesis of mixtures containing standard amounts of frog brain and serum from control subjects was compared with the acetylcholine synthesis of mixtures of frog brain and of serum of patients with myasthenia gravis. Using a modified method of Quastel, Tennenbaum and Wheatley,[7] the mixtures were incubated for a standard period at a standard temperature and the acetylcholine content ascertained by means of the rectus abdominis muscle of frog (Riesser,[8] Chang and Gaddum[9]). The amount of acetylcholine synthesized during the incubation was calculated by subtracting from the content of each incubated sample the acetylcholine content of identical non-incubated samples.

Results: Mixtures containing serum and frog brain synthesized more acetylcholine than mixtures containing Ringer's solution and frog brain. Freshly prepared frog brain-serum mixtures contained 0.38 γ acetylcholine per 100 mg of tissue. As a result of incubation 1.45 γ acetylcholine was produced. In contrast the acetylcholine synthesized from the mixtures of frog brain and serum obtained from patients with advanced myasthenia gravis was approximately one third as much (0.53 γ). Six patients with myasthenia gravis have been compared with forty-eight control subjects.

At least some of the agents which modify acetylcholine synthesis are dialyzable.

Comment: The decrease of acetylcholine synthesis is apparently specific for myasthenia gravis, since it does not occur with other diseases presenting debility, cachexia, immobility and prostration. Also the magnitude of defect in acetylcholine synthesis is related to the severity of the myasthenia gravis.

Conclusion: The defect in acetylcholine synthesis in patients with myasthenia gravis probably explains the fatiguability and weakness of these patients.

CLARA TORDA
HAROLD G. WOLFF

SCIENTIFIC APPARATUS AND LABORATORY METHODS

CORTICOTROPIN OBTAINED BY ULTRAFILTRATION OF PITUITARY EXTRACTS[1]

IT is generally believed that hypophyseal corticotropin is protein in nature, as are the other hormones of the anterior pituitary, and consequently non-dialyzable. Purification has been directed towards the isolation of a protein, and dialysis has been used as a means for removing impurities of smaller molecular size. However, the stability of certain of the anterior pituitary hormones when exposed to drastic chemical procedures suggests that they may be of small molecular size.

In recent experiments it was found that dialysates of hog pituitary extracts contained a factor which increased the size of the adrenals in hypophysectomized rats. The observation was first made with a dialysate of a glacial acetic acid extract[2] of acetone-dried hog pituitary powder. The material had dialyzed for a period of two weeks against an equal volume of water, and the dialysate was used directly for injection into immature hypophysectomized male rats. In subsequent experiments extracts were ultrafiltered through Cellophane membranes (Visking sausage casing) under the pressure of a water column of approximately six feet. The ultrafiltrates were perfectly clear and almost colorless. The active material was precipitated by adding solid sodium chloride to the ultrafiltrate at a pH 4.0 until a molarity of 4.5 was reached. The subsequent addition of ammonium sulfate to a molarity of 1.5 brought about further precipitation of active material from the supernatants of the ultrafiltrates previously nearly saturated with sodium chloride. The salt precipitates were dried with ether. Another effective procedure for obtaining the activity from the original ultrafiltrates was found in the freezing-drying technique.

The amount of active substance obtained was determined by assay[2] in hypophysectomized rats. The relation of dose to response followed the parabolic assay curve which was based on the activity of hog whole pituitary powder. As the ultrafiltrates showed a biuret reaction, the intensity of which closely paralleled its hormonal activity, the amount of active substance was expressed in equivalents of protein as determined by photoelectric colorimetry. The amount of protein equivalents relative to the solids obtained by the above procedures and the activity in units, as defined, are given in Table 1. The yield of corticotropin obtained by ultrafiltration of a glacial acetic acid extract for six days, with change of the membrane every 24 hours, is expressed in Table 2 in percentage of the activity of the extract. Nearly half of the solids of the extract passed through the membrane and contained 38 per cent. of the total activity of the extract. The part remaining within the dialysis bag contained 28 per cent. of total activity. The powders obtained from the ultrafiltrates showed a better solubility in water than the original material or the residue after ultrafiltration. The solutions also contained less color. The biuret, Hopkins-Cole, Millon and Sakaguchi reactions were positive. A 0.1 per cent. solution of the material showed immediate precipitation upon addition of phosphotungstic or phosphomolybdic acid, but not with trichloracetic or picric acid. The activity was not destroyed by boiling the solution for ten minutes. The ultrafiltrates of glacial acetic acid extracts were free from gonadotropic and thyrotropic hormones.

---

[3] *Jour. Clin. Invest.*, 5: 649, 1938.

[4] *Rev. Soc. Arg. Biol.*, 13: 239, 1937.

[5] Harvey and Lilienthal, *Bull. Johns Hopkins Hosp.*, 69: 566, 1941.

[6] Harvey, Lilienthal and Talbot, *Jour. Clin. Invest.*, 21: 579, 1942.

[7] *Biochem. Jour.*, 30: 1668, 1937.

[8] *Arch. für exper. Path. u. Pharmacol.*, 91: 342, 1921.

[9] *Jour. Physiol.*, 79: 255, 1933.

[1] Under the auspices of the Committee on Pharmacotherapy, Harvard University. Supported by the National Research Council.

[2] Details of the extraction procedure and assay method will be published elsewhere.

TABLE 1

CORTICOTROPIN OBTAINED BY SALTING OUT OR BY FREEZING AND DRYING ULTRAFILTRATES OF EXTRACTS OF HOG PITUITARY

Number of animals	Material obtained from ultrafiltrates	Mgm. protein* equivalents per 1 gm of solids	Units† per 1 gm of protein equivalents	Units† per 1 gm of solids
8	(a) 4.5 M NaCl precipitate	484	120	58
5	(b) 1.5 M $(NH_4)_2SO_4$ precipitate from supernatant of (a)	255	102	26
9	(c) Total solids obtained by freezing and drying	286	125	36

* Amount equivalent to protein as measured photoelectrically by the biuret reaction.

† 1 unit is equivalent to the activity of 12 mgm of acetone-dried hog pituitary powder which elicits a 100 per cent. increase of the adrenal weight in the hypophysectomized rat over a five-day injection period.[2]

TABLE 2

YIELD OF CORTICOTROPIN OBTAINED BY FREEZING AND DRYING AFTER ULTRAFILTRATION FOR 6 DAYS OF A GLACIAL ACETIC ACID EXTRACT OF ACETONE-DRIED HOG PITUITARY POWDER. CHANGE OF THE MEMBRANE EVERY 24 HOURS

	Solids gm	Activity units	Percentage of total activity
Glacial acetic acid extract; 2 M NaCl precipitate	4.00*	205	100
Material obtained by ultrafiltration; frozen and dried	2.18	79	38
Residue after ultrafiltration; 2 M NaCl precipitate	2.69	58	28

* As calculated from the weight of the precipitate of one ninth of the extract.

The fact that a corticotropic substance passes through a Cellophane membrane indicates the probability that its molecular size is smaller than has been assumed. In order to determine whether the extraction with glacial acetic acid resulted in the splitting of an active group from a larger molecule or whether there were active groups of smaller molecular size in the original acetone-dried powder, the following experiments were performed. The acetone-dried powders of sheep and beef pituitaries were suspended in water and adjusted to pH 3.0 with hydrochloric acid. Suspensions of hog pituitary powder were similarly adjusted to pH 3.0 and to pH 9.0 and 10.0, respectively, with sodium hydroxide. Corticotropic activity was demonstrated in the ultrafiltrates of all five of these solutions, showing that the unextracted acetone-dried powder of the pituitary contained under those conditions a corticotropic substance of a relatively smaller molecular size.

Summary: A substance with corticotropic activity has been obtained by dialysis and by ultrafiltration of pituitary extracts.

Acknowledgment is made to Dr. E. B. Astwood, of the Department of Pharmacology, to Dr. R. Cleveland, assistant editor of the journal *Endocrinology,* and to Dr. E. J. Cohn and Dr. J. L. Oncley, of the Department of Physical Chemistry, Harvard Medical School, Boston.

R. TYSLOWITZ

THE DEPARTMENTS OF PHARMACOLOGY AND
MEDICINE, HARVARD MEDICAL SCHOOL,
AND THE MEDICAL CLINIC OF THE PETER
BENT BRIGHAM HOSPITAL,
BOSTON, MASS.

BOOKS RECEIVED

CLARK, AUSTIN H. *Iceland and Greenland.* Illustrated. Pp. iv + 103. Smithsonian Institution.

DE KRUIF, PAUL. *Kaiser Wakes the Doctors.* Pp. 158. Harcourt, Brace and Company. $2.00.

JACOBSON, NATHAN. *Mathematical Surveys Number II. The Theory of Rings.* Pp. vi + 150. American Mathematical Society.

JENSEN, DEBORAH MACLURG. *An Introduction to Sociology and Social Problems.* Illustrated. Pp. 420. C. V. Mosby Company.

RAYLEIGH, LORD. *The Life of J. J. Thomson.* Illustrated. Pp. x + 299. The University Press at Cambridge and Macmillan Company. $6.00.

SHOHAT, J. A. and J. D. TAMARKIN. *Mathematical Surveys Number I. The Problem of Moments.* Pp. xiv + 140. American Mathematical Society.

WALTON, C. E. *Civilian Defense.* Illustrated. Pp. 156. Bruce Humphries, Inc. $1.50.

SCIENCE

Vol. 98 Friday, September 10, 1943 No. 2541

Discovery in Eastern Washington of a New Lobe of the Pleistocene Continental Glacier: Professor William H. Hobbs 227

Branches of the Academy of Sciences of the USSR. II: Dr. P. Kolesnikov 231

Obituary:

Karl Landsteiner: Dr. Michael Heidelberger. *C. Stuart Gager:* Dr. William J. Robbins. *Deaths and Memorials* 233

Scientific Events:

Scientific Research in Great Britain; The Canadian Aircraft Standards Technical Committee; The Lewis Cass Ledyard, Jr., Fellowship of the Society of the New York Hospital; Grants for Research in Applied Psychology; The "B-Complex" Award of Mead Johnson and Company; The Nutrition Foundation; The Fiftieth Anniversary of Field Museum of Natural History 235

Scientific Notes and News 238

Discussion:

Scientific Research by the Department of Agriculture: T. Swann Harding. *A Tea Prepared from Needles of Pine Trees Against Scurvy:* Dr. Bela Schick. *Vitaman C in Evergreen-Tree Needles:* Dr. Charles Macnamara 240

Scientific Books:

Psychology for the Fighting Man: Dr. Leonard Carmichael. *Fundamentals of Immunology:* Professor E. G. D. Murray. *Inorganic Qualitative Analysis:* Dr. D. P. Smith 242

Special Articles:

The Influence of Methyl Chalcone of Hesperidin on the Toxicity of Mapharsen in Rabbits: Dr. David H. Goldstein, Dr. Abraham Stolman and Dr. Arthur E. Goldfarb. *The Antibacterial Effect of Enzymatic Xanthine Oxidation:* Dr. Fritz Lipmann and Cora R. Owen 245

Scientific Apparatus and Laboratory Methods:

A Simple Three-Color Mixer Using Filtered Colors: Dr. Walter F. Grether 248

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell; Ware Cattell, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

DISCOVERY IN EASTERN WASHINGTON OF A NEW LOBE OF THE PLEISTOCENE CONTINENTAL GLACIER

By Professor **WILLIAM H. HOBBS**
UNIVERSITY OF MICHIGAN

Studies made during the past field season[1] in eastern Washington have disclosed the presence there in Late Pleistocene time of a hitherto unsuspected lobe of the Cordilleran continental glacier. This lobe covered an area of nearly four thousand square miles and is to be known as the Scablands Glacier Lobe. It blocked the Spokane River of that time to impound the waters in Glacial Lake Spokane. This lake included the basins of Lakes Coeur d'Alene and Pend Oreille and extended across Idaho into Montana (see Map I). Its area was thirty-one hundred square miles. When the glacier had evacuated the Scablands, Lake Spokane expanded a distance of one hundred miles down the canyons of the Spokane and Columbia rivers to the site of Coulee Dam as Glacial Lake Leverett.

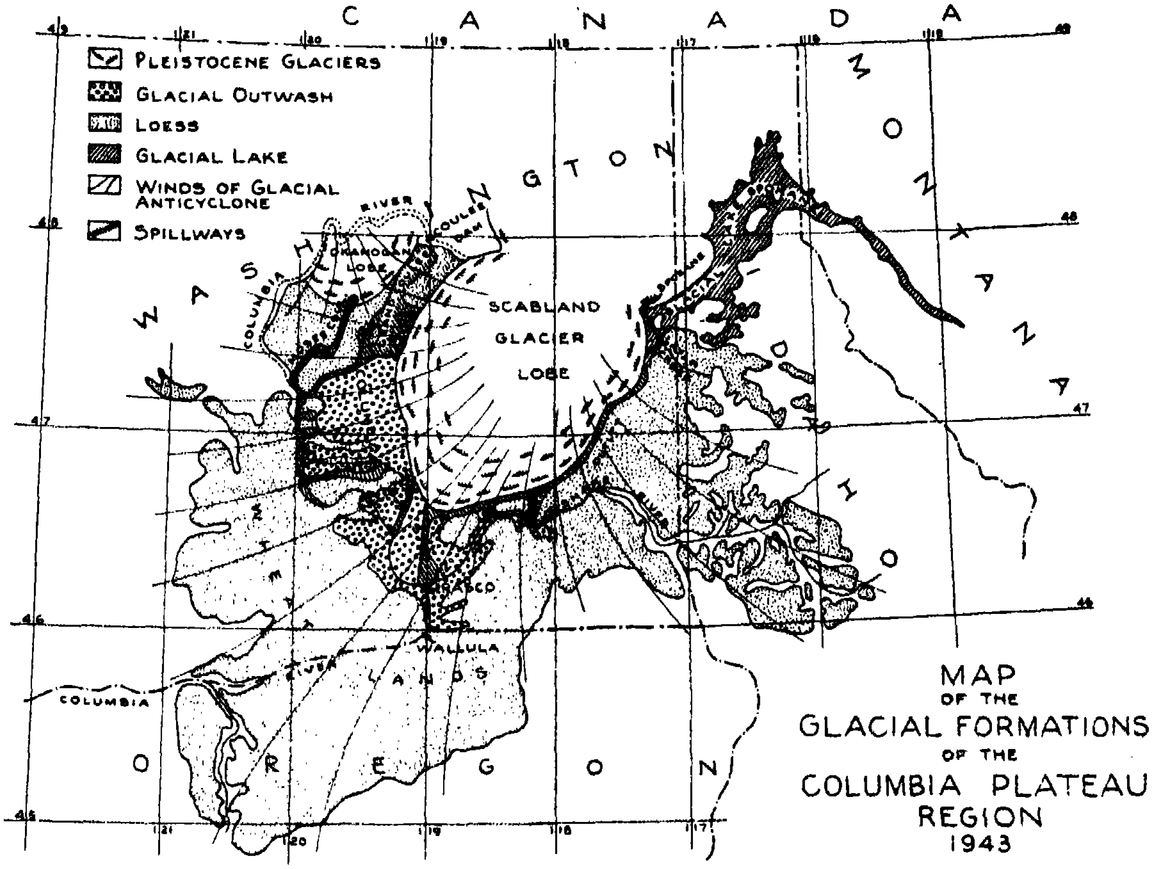
The lava plain which lies to the southwest of Spokane has a surface development almost unique, and has long been known to its inhabitants as the "scablands." To geologists of the late decades it is known as the "channeled scablands" from the apt description by Professor J Harlen Bretz,[2] who has devoted years to its study. Many other geologists have made brief references to it, and one of them, Professor Richard Foster Flint,[3] has studied it extensively.

---

[1] With the aid of grants from the American Philosophical Society and the Geological Society of America. This preliminary notice is printed by permission.

[2] Of Dr. Bretz's many papers treating of the area the

All students of the area seem to have been in agreement on at least one point, that the southernmost border of the Cordilleran glacier was mainly to the north of the Scablands, and near the southern margin of the area of the crystalline rocks. This is near the present courses of the Spokane and Columbia Rivers.



Map I. Glacial map of the Scablands and surrounding area. The boundary of the outwash and the spillways are based on the map by Bretz (*Geog. Rev.*, 18: pl. V), and that of the loess on the map by Marbut ("Atlas of American Agriculture," Pt. III, "Soils of the United States," pls. 4 and 5, sec. 4).

Concerning the origin of the scablands surface there has been little agreement except upon one point, that at some time during the late history torrents of water have played a part. To these torrents Bretz has even ascribed the excavation of the channels with their rock basins and the modeling of the present surface. This surface has a character which is wholly unfamiliar to American geologists from studies made elsewhere, and it certainly bears little resemblance to the accepted features from operation of any of the known geological agents.

In general it may be said that the scablands surface is made up of anastomosing channels within the basalt, channels which are arranged on the plan of braided streams above a plain of outwash. Separating the channels are residual low mesas—black and barren—which are the "scabs." These are bounded by precipitous walls, often terraced, sometimes a hundred feet or more in height.

Scattered on the floors of the channels are hundreds of rock basins, large and small, generally filled with water but sometimes with gravel. Along the sides of the channels are local deposits of gravel, which Bretz has called "bars," and gravel is found also clinging in niches of the walls. This gravel is clearly the residue only of much larger deposits which have been in greater part swept away.

On the larger residual islands between the channels

---

latest and most comprehensive with an excellent map is "The Channeled Scablands of Eastern Washington," *Geog. Rev.*, 18, 446–447, 1928.

[3] Richard Foster Flint: *Bull. Geol. Soc. Amer.*, 47, 1849–1884, 8 pls., 2 figs., 1936; *ibid.*, 48: 203–232, 5 pls., 1 fig., 1937; *ibid.*, 49: 461–524, 10 pls., 11 figs., 1938.

are heavy deposits of dark brown loess in character identical with that which surrounds the scablands on east, south and west and constitutes the rich wheat lands. These islands are scabs masked by their loess cover.

Against the view of Bretz that the channels and their rock basins have been excavated by torrents of water is the recognized fact that no such features have been produced by running water in any other part of the world. The rock basins of the scablands are found in the wider channels particularly, and rock basins are an almost universal feature of glaciated regions. It is the channels with their included low mesas which are the unique feature of the scablands. If such features seem to be unique, it is almost unique for glaciers to have advanced over lava plains. Nowhere in the world except in Iceland has an ice sheet, either ice cap or continental glacier, been known to have overridden flat lava beds. The lava flows of the Columbia plains reveal within the *same* bed the widest differences of character. In one place the structure may look like a sponge, it is coarsely vesicular or scoriaceous. Elsewhere it is hard and firm, and the residual mesas have this character. The vesicular lava is especially vulnerable to the glacier's initial attacks by plucking, and after it had been quarried from the rock bed the rock must have been crushed and so made incapable of effective abrasion of the bedrock. The till of the moraines should therefore be poor in clay and characterized by smaller rock nodules, perhaps of pebble size. The vesicular facies of the lava flows are extended in the direction of flow, and if tapped from the preglacial valleys might well yield a channeled rock surface when the glacier had overridden it. Now the area overridden by the Icelandic glaciers supplies a close parallel to the topographic development of the Scablands.[4]

If the scablands of Washington have been glaciated, as have those of Iceland, we should be able to find a marginal moraine outlining its border. This moraine has now been found at many places[5] on the border of the area, where the till is notably poor in the clay constituent and with a preponderance of nodules of pebble size. Less complete data were collected for several recessional moraines, since these have been mutilated by the later torrents of water.

The outwash from the Scablands Glacier Lobe occupies the greater part of the Columbia Basin, which is composed of the Quincy Basin at the north and the Pasco Basin to the southeast (see Map I). During the retreat of this lobe, outwash filled also the channels of that part of the scabland already vacated.

Studies made of the glacial anticyclone of the continental glacier of Greenland have shown that wherever glacial outwash has been laid down, loess must inevitably be deposited within the periglacial area extramarginal to the outwash, and in deposits which thin out gradually from it.[6] Such evidence must always be sought, and as proof of the former presence of a glacier it is not less important than the proven existence of a marginal moraine.

Surrounding the Columbia Basin of outwash on west, south and east is a heavy deposit of loess which thins outward gradually until it disappears (see Map I). The higher mesas of the scablands also, which became nunataks during the retreat of the glacier front, received loess deposits from outwash which was then within the channels still farther back toward the retreating glacier front. Both in the outer and inner deposits wells have revealed thicknesses of loess of much more than one hundred feet.

During the glacier retreat vegetation encroached upon the main outwash area, and this permitted a thin veneer of loess, though everywhere in excess of five feet, to be laid down over the outwash plain. It is this rich deposit which veneers also the older loess that has made possible the Columbia Basin Irrigation Project.

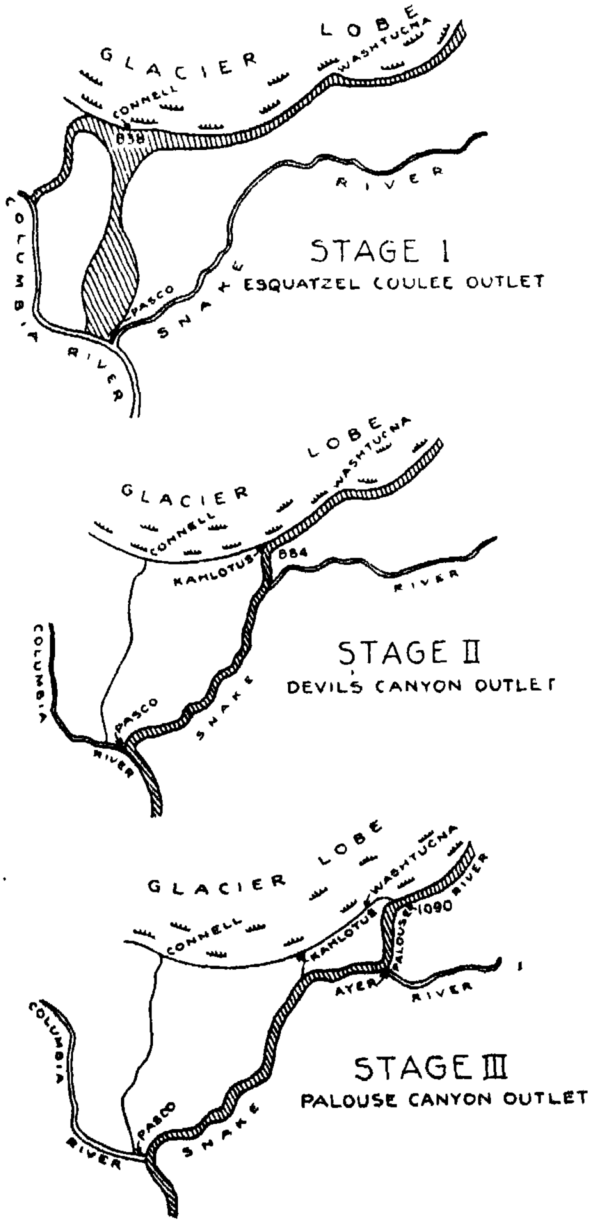
The manner in which by the normal planetary air circulation the glacial anticyclone is progressively overcome and the dissolution of the glacier at last accomplished, has indicated that for each glacial ring between recessional moraines there is a final stage characterized by floods of thaw water. The already much thinned dead ice under its network of glacial streams and lakes is separated into ice-rafts, which by the floods are floated out above the outwash. In the scablands these floods must have been largely contained within the rock channels and in consequence attained torrential velocities sufficient to sweep out most of the outwash, leaving only the "bars" and other localized gravel. At times the rafts of ice must have jammed to produce dams within the rock channels, above which the flood water was temporarily impounded. The level was thus raised and the loess deposits on either side were undermined and cliffed, sometimes at more than one level. The escape channels on the two sides of the jams must have sometimes been occupied by streams at different levels and loess cliffs would fail to pair, a fact which Flint has stressed as characteristic of the scablands. Other floods which coursed through the rock channels of the scablands were connected with later outlets from Lake Spokane, after they had been unblocked through retirement of the ice front.

---

[4] Gudmundur Kjartansson, *Med. fra Dansk Geol. Foren.*, 9: 426–458, Copenhagen, 1939.

[5] Under wartime inhibitions within a specially restricted area, which prevented the use of a motor car, it has not been possible to visit the border throughout, but at every point visited (some twenty-five in all and well distributed) the moraine was found.

[6] *Jour. Geol.*, 39: 381–385, 1931; 50: 556–559, 1942. *Proc. Amer. Phil. Soc.*, 86: 368–402, 1943. *Am. Jour. Sci.*, 241: 333–336, 1943.



Map II. Successive outlets of glacial Lake Spokane.

In its stage of maximum development the Scabland Lobe blocked a glacial ancestor of the present Spokane River and impounded the waters in Glacial Lake Spokane over an area of thirty-one hundred square miles. The outlet in this stage was a spillway along the eastern and southern borders of the lobe to near Connell, and thence over the outwash to the Columbia River near its confluence with the Snake.

The outlet's right bank was the glacier and it had a rock sill at 2508′ A.T., four miles northwest of Waverly and twenty-two miles south southeast of Spokane. The water level of the lake was at 2520′ A.T., the level of the highest delta of glacial Latah Creek which discharged into it south of that city.

An advance of the southern front of the lobe closed the initial outlet of Lake Spokane near Connell with its sill at 838′ A.T., and this forced the water to escape into the Snake River by an outlet near Kahlotus, where the sill was at 884′ A.T. (see Map II, parts I and II). This outlet cut the Devil's Canyon. A slight further advance of the ice front closed in its turn the Kahlotus outlet and opened one some thirty miles farther east below Hooper (see Map II, part III), where the sill is near 1246′ A.T. This outlet cut the Palouse Canyon of grandiose proportions so impressively displayed to travelers proceeding southward by railway along its rim.

Six later stages of Lake Spokane were due to as many halting retreats of the glacier front. The outlets were in succession throughout at Cheney with the three spillways already mentioned, which functioned in reverse order, then Koontz Coulee, Lower Crab Creek and, finally, Upper and Lower Crab Creek.

Upon the complete evacuation of the Scablands with the glacier front now north of the Spokane and Columbia rivers, Lake Spokane expanded down the valleys of these rivers to the site of the Coulee Dam. This lake, which I have named Lake Leverett, in a transitional stage had outlets at Cheney (sill at 2345′) and through the Grand Coulee (sill near Steamboat Rock at around 2300′). It was dammed by the first recessional front of the Okanogan Glacier Lobe some fifteen miles west of Coulee Dam. A later stage, dammed near Bridgeport by the third recessional front, extended another fifty miles down the Columbia valley with a bay which covered most of the Waterville Plateau. The Cheney outlet had now been abandoned with a new one opened through the Moses Coulee. Both these outlets operated simultaneously and contained cataracts, that in the Grand Coulee with a fall of over 800 feet, or more than five times as high as Niagara and easily the greatest feature of the kind that is known.

With an original water level of 2366′ A.T. Lake Leverett had later stages of 2345′, 2057′ and 1957′ and 1885′, all registered in gravel plains under the city of Spokane and in somewhat lower sill levels within the Grand Coulee.

BRANCHES OF THE ACADEMY OF SCIENCES OF THE USSR. II

By Dr. P. KOLESNIKOV

VICE-CHAIRMAN OF THE COMMITTEE OF BRANCHES AND BASES OF THE ACADEMY OF SCIENCES OF THE USSR

SEVERAL institutes and branches of the Academy of Sciences widely avail themselves of the agricultural methods evolved by Academician Lysenko.

On the basis of Lysenko's methods, for instance, the collaborators of the Armenian Branch have attained a sharp increase in the crop of beets, a branch of agriculture practically new to Armenia. In 1938 the area of sugar-beet cultivation here was about 2,500 acres, whereas to-day it has been doubled. The experiments conducted by Manaseryan, a collaborator of the Armenian Branch, have shown the full feasibility of planting beets in the lowland areas after the harvesting of the cereal crop. This method of post-harvest planting of beets has been introduced in a number of districts, and some of the collective farms reap a crop of up to 24 tons per acre.

Another worker of this Branch—Ter Saakyan, has obtained a second crop of potatoes (after summer planting), the yield reaching as high as 11.2 tons per acre.

In addition to this the Armenian Branch has accomplished valuable research on topping cotton plants, on raising high-crop yield rust-immune wheat and also drought-resistant fodder cultures.

Interesting work conducted by collaborators of this branch include that establishing the beneficial influence wielded by intra-sort crossing of winter wheat in regard to its frost-resistance, the formation of ears, the absolute weight of grains and other commercial features. By decision of government organs of the Armenian Republic, the collective farms, under supervision of the Biological Institute of the Armenian Branch, are working on intra-sort crossing of winter wheat and on multiplying the resultant seeds with the aim of universally introducing sowing with such intra-sort cross seeds within the next few years.

One of the collaborators of the Armenian Branch has raised a new sort of winter wheat yielding a maintained harvest and resistant to yellow- and stalk-rust.

Based on these same methods worked out by Lysenko, the collaborators of the Kazakh Branch have bred an interesting hybrid sheep, yielding a fine-fleece wool.

As is common knowledge, not a single breed of fine-fleece sheep is adapted for existence at high altitudes above sea level. As a result of crossing merino sheep with the wild Arkhar Mountain ram, 600 head of second, third and fourth generation offspring have already been obtained. This new breed of sheep has a considerably better wool yield than the local breed, the average shearing yield per two-year hybrid sheep equaling 3 kilograms and from the hybrid ram 4½ kg as compared with 1–2 kg obtained from the local breed.

Under the charge of Academician Pavlovsky, the Tajik Branch has done interesting work on the prophylaxis of recurrent typhus caused by ticks. The tasks set by Pavlovsky—to ascertain the distribution of the tick vector of recurrent typhus, to study the ecology of the carrier of this disease and to work out a system of prophylactic measures suited to the conditions of Tajikistan—have been successfully accomplished. Research investigations (Khorezm and West Pamir) found that the causal agent of this disease—the spirochaeta—is carried by ticks, from which it is transmitted to humans. The department of parasitology of the Tajik Branch has worked out methods for prophylactical measures against recurrent typhus, which, in 1940, were tested in practice, with positive results.

Botanical gardens, experimental plots, natural preserves and research stations of the Academy of Sciences branches are to be found in the sub-tropical regions, in the area beyond the Arctic Circle, in the Far East, etc. Intensive work on remaking nature is proceeding in all latitudes.

Vast and thick growths of wild fruit trees and shrubs are to be found on the territory of the Tajik Republic, and the scientists resolved to transform these dense jungle growths into cultivated orchards. Sweet almond, peach and plum were grafted to the wild, bitter almond. By similar means, a local variety of medlar, yielding no fruits, was made to serve as a parent stock for raising quince and pear fruit.

The first crop of peaches raised on the site of former wild growths was obtained last year on the experimental plots of the Tajik Branch.

The Pamir Biological Station of the Tajik Branch of the academy—the only station of its sort in the world—conducts very interesting work. This station has proved that barley can be cultivated at an altitude of 11,500–12,500 feet above sea level. In 1940 this crop yielded from 10.4 to 19.2 cwts per acre here and up to 2–6 tons of straw per acre, the latter, thanks to its high sugar content and soft fibers, forming a particularly good fodder.

Truly bumper crops of radish—8 to 10 tons per acre—are obtained in East Pamir, as well as fine turnip crops of 16 tons per acre.

The problem of introducing the cultivation of potatoes and vegetables in West Pamir, at altitudes ranging from 6,500 to 10,000 feet, has now been solved. Agriculture existed here formerly too, but on a very small scale. Some of the potato growers here have obtained a harvest reaching 40 tons of centifolia potatoes per acre.

The academy branches play an important role in mustering and linking up scientific forces on the spot.

Nearly all the branches and bases convene scientific conferences, sessions and gatherings. The Urals Branch, for instance, convened a special session which met at the Chelyabinsk Tractor Works. Jointly with the workers of this engineering plant, the session outlined interesting problems in the sphere of heat treatment of metal and methods of mechanical casting.

In Tbilisi the Georgian Branch held a conference on mathematics, dealing with the theory of elasticity. The Kola Peninsula Base convened five conferences—in Kirov, Moscow and Monchegorsk—dealing with several important problems of this region.

The Georgian Branch likewise conducts work in the sphere of astronomy. The first mountain astrophysical observatory in the USSR is now under the auspices of the Georgian Academy of Sciences. This observatory, situated not far from the Abastumani health resort, stands on a mountain 5,500 feet above sea level, where the atmosphere is particularly clear. This observatory, which nestles amid greenery, is equipped with a 16-inch refractor and camera for observing and photographing the stars and minor planets, a spectrohelioscope for studying the solar surface, an aberration telescope for observing remote nebulae, etc.

Last year the scientific workers of the Abastumani observatory discovered three new minor planets.

Information concerning the results of Abastumani astronomical observations are published in the USSR and abroad. This observatory also publishes a special bulletin of its transactions.

The republican branches and bases of the Academy of Sciences of the USSR also conduct considerable research in the history of culture, lettering and arts of the peoples of the Soviet Union.

The academy branches have amassed interesting data on material culture. Excavations conducted under the supervision of the late Academician I. Djavakhishvili unearthed at Mtseti-Santavro (Georgia) 400 burials of various types, relating from the twelfth century before our era to the sixth century of the present era. A necropolis of high dignitaries and Iberian kings, relating to the second and third centuries of the present era, has been unearthed in Armavir. Exceedingly valuable historical material has been collected—decorations of gold, silver and precious stones, domestic objects, weapons and articles of cult.

I. Khoshtaria, a scientific collaborator, has unearthed and investigated a Neolithic dwelling in the village of Urta, where polished and hewn implements were found, as well as the most ancient pottery known so far in Georgia.

Equally deserving of mention are the archeological investigations on the site of the ancient city of Ganja, where considerable numbers of artefacts have been unearthed, relating to the pre-feudal and feudal life of ancient Azerbaijan.

Excavations at the ancient Armenian town of Dvina have furnished archeologists with interesting objects referring to the culture and production of Armenia in ancient times. During the centuries-long existence of the Armenian nation a vast amount of material has been amassed characterizing the development of science and the production in various periods of time. This collection, in particular, numbers about 23,000 documents. The collaborators of the Armenian Branch have commenced the systematization and publication of this priceless cultural heritage of the talented Armenian nation.

Under the direction of Professor Ter-Avetisyan, one of the collaborators of this branch, Kafedaryan, is conducting excavations in the ancient state of Urartu. Palaces, granaries, capital walls, shields, arrows, seals, utensils and other valuable objects have been so far unearthed, all this substantially extending our knowledge of the Urartu kingdom and its times.

The Armenian Branch recently convened a special session dedicated to the millennial of the great folk epic "David of Sasun."

In connection with the preparations being made to celebrate the eight hundredth anniversary of the birth of Nizami Ganjawi, the Azerbaijan Branch is putting out a number of interesting publications of works and essays about Nizami and his days.

Another important sphere of work conducted by the academy branches is that relating to language and literature. Corresponding member of the Academy of Sciences of the USSR Shanidze—a collaborator in the Georgian Academy of Sciences—has prepared for publication "An Okshuk Ms. of 978" and a "Papyrus-Parchment Mineus of the Ninth Century," both of which represent ancient monuments of the Georgian language.

Several collaborators have compiled a dictionary of the Georgian language, embracing about 14,000 words.

This branch has accomplished a major undertaking in drawing up a new alphabet. A group of philologists of the Azerbaijan Branch has completed the compilation of the new Azerbaijan alphabet, based on the Russian lettering, and has reworked the orthographical dictionary.

Besides this the workers in this branch have compiled an Azerbaijano-Russian and Russo-Azerbaijan dictionary, more than 120 printer's signatures in size.

Major work is likewise being done on preparing a catalogue of ancient Armenian MSS—a rare collection of literary monuments of Armenia and neighboring countries.

Considerable work has also been accomplished in putting out text-books in the languages of different nationalities—university and secondary-school text-books having been published on the history of the peoples of Georgia, Azerbaijan and Armenia.

A five-volume "History of the Armenian People" is at present being prepared under the supervision of Academician A. Manandyan.

The importance of the work accomplished by the branches and bases of the Academy of Sciences of the USSR in 1940 was highly appreciated by the governments of the USSR and of the Union republics, 38 scientific workers of the academy branches having been awarded orders and medals and the title of Merited Scientist being conferred upon some of them, while others were awarded certificates of honor.

The growth and progress of national cadres in the scientific research institutions of the academy branches speaks of the flourishing of science in the national republics of the Soviet Union and of the rapid development of the productive forces in these former backward regions.

OBITUARY

KARL LANDSTEINER

Dr. Karl Landsteiner, member of the Rockefeller Institute for Medical Research, died on June 26, 1943, after a very brief illness which came upon him in his laboratory at the height of his activity, depriving the world of a great immunologist and, in the broader sense, of a truly great scientist.

Born in Vienna in 1868, Landsteiner grew up in the period of rapid development of the biological sciences. A doctor of medicine at 23, he sensed the importance of organic chemistry and studied with Emil Fischer before turning to research in bacteriology and pathology. Just at this time these fields of investigation were seething with excitement over the successes of antitoxins, the applications of bacterial agglutination and the complexities of hemolysis.

Within ten years, Landsteiner had announced the subtle but incalculably important differences in human bloods, the knowledge of which has saved countless lives, and for which he received the Nobel Prize in Medicine in 1930. He was also the first to transmit poliomyelitis to monkeys, a procedure which made experimental study of the disease possible. Early investigations with Donath on cold agglutinins resulted in the development of a most valuable and frequently used diagnostic test. Still studying blood relationships in 1940, Landsteiner, with Wiener, discovered the so-called *rhesus* factor in blood cells, the great practical importance of which is rapidly becoming evident largely from the work of Levine.

During all Landsteiner's activity in Europe and in the United States he kept pace not only with medicine and the biological sciences, but with the intricacies of rapidly expanding chemical and physical thought as well. Shortly after coming to this country in 1922 he proposed a study of the solubility of pure crystalline oxyhemoglobin of one species in a saturated solution of that of another species as a means of establishing the identity or chemical difference of the two proteins. The idea and its successful execution were the natural outgrowth of his comprehension of a section of Planck's treatise on the "Quantum Theory," which he was reading at that time. This method of studying protein solubilities was later modified and developed by Northrop and his school into one of the most rigid criteria of the purity of proteins.

Landsteiner early in his career realized, as had Ehrlich, the essentially chemical basis of immunity and the chemical nature of the serological reactions by which immune processes are made evident. Years ahead of his time, before the advent of micro-methods and micro-balances, he weighed specific precipitates in the presence and absence of complement, but the equipment available was not sensitive enough to show the significant differences that actually occur.

Aware of the complex structure of the natural protein antigens and the difficulty of tracing the chemical groupings responsible for the serological reactivity and specificity of these substances, although he had made contributions in this direction as well, Landsteiner turned to the effect on specificity of the introduction of known chemical elements and organic groupings, building upon an earlier study by Obermayer and Pick. Using principally the diazo reaction for coupling aromatic amines with proteins to form azo compounds, Landsteiner and his collaborators demonstrated the creation of a new specificity characteristic of the entering group, or hapten, showed the importance of position-isomerism in the entering aromatic groups, and charted the interrelationships of similarly and differently spaced groupings of all kinds. The discovery that simple substances, chemically related to the hapten, inhibited the specific precipitation of the new antigen and its antibody in proportion to the nearness of relationship to the entering group greatly facilitated the testing of large numbers of substances and made unnecessary the often difficult process of preparing an antigen with each. With this material, he was able to discuss and describe immunological specificity in terms of known chemical groupings of simple structure. Perhaps the most spectacular outcome of this work, and a closer point of contact with the specificity of native proteins, was the demonstration with van der Scheer that the order of amino acids in di-, tri- and tetra-peptides was a major directive influence on the specificity.

Landsteiner's book, "The Specificity of Serological Reactions," not only summarizes these researches but places them in their proper perspective in a broad field in masterly fashion.

Of prime importance, also, has been the long series of investigations carried out by Landsteiner and Chase on skin-sensitivity to simple chemical compounds, a study which laid a scientific basis for new concepts of allergy and its mechanisms. Especially noteworthy was the finding that sensitization results most easily from compounds capable of combining with reactive protein groupings and thus presumably forming new antigens foreign to the organism. And no less important were the final joint studies of these collaborators, as yet unpublished and unfinished, on the transfer of acquired sensitivities of this type.

In the laboratory, Landsteiner was the authoritative and energetic director of research; but outside, in his personal contacts, he was diffident, shy and quiet, though his flashes of genial wit were apt to enliven any conversation in which he took part. When he did address a gathering, he was stimulating, inspiring and brief. He played the piano with a sensitive touch and musicianly understanding, but was as reticent in exhibiting these talents as he was in talking of his work.

Dr. Landsteiner's wife and their son, a surgeon, survive him, but he is mourned as well by a host of friends and scientists who not only revered him for his intellect and attainments, but for his genial accessibility and inspiring counsel, as well.

MICHAEL HEIDELBERGER

C. STUART GAGER

AMATEUR and professional horticulturists and botanists have lost a leader and a friend in the death of Dr. Charles Stuart Gager, director of the Brooklyn Botanic Garden, after a short illness, at Waterville, Maine, on August 9.

Dr. Gager was born in Norwich, N. Y., on December 23, 1872, the son of Charles Carroll Gager and Leora Josephine Darke Gager. He received his A.B. degree from Syracuse University in 1895. The New York State Normal College at Albany conferred degrees of bachelor and master of pedagogy on him in 1897, and he received the Ph.D. degree in botany from Cornell University in 1902. Syracuse University gave him the D.Sc. in 1920, and the New York State Normal College a doctor of pedagogy in 1921. In 1902 he married Bertha Woodward Bagg, and two children, Benjamin Stuart (deceased) and Ruth Prudence (Mrs. Kenneth G. Bucklin) were born.

Beginning as a laboratory assistant at Syracuse University in 1894–95 he became vice-principal of the Ives Seminary at Antwerp, N. Y., in 1895–96; professor of biological sciences and physiography at the New York State Normal College, 1897–1905; director of laboratories at the New York Botanical Garden, 1906–08; and professor of botany at the University of Missouri, 1908–10. In addition he taught for short periods at the Morris High School in New York City, at Cornell University, Rutgers University and New York University. In 1910 he was called to become director of the Brooklyn Botanic Garden, to the development of which he devoted the balance of his life. Starting with an area of waste land he created one of the outstanding institutions of its kind.

His botanical interests were primarily physiological and, while associated with the New York Botanical Garden, he initiated one of the earliest investigations of the effect of radium upon plants. Administrative duties and other demands prevented him from developing what might easily have become a brilliant career in research.

Always generous with his energy and his time he served on many committees and boards of horticultural and botanical organizations. His addresses, freely given on numerous occasions, were carefully prepared and always spiced with humor and some unusual or unique point of view. In spite of his numerous other duties and activities, he found time to publish several books on teaching, botany and genetics, and to act as editor or business manager of important botanical periodicals, including the *American Journal of Botany, Ecology* and *Genetics.*

Among other societies Dr. Gager was a member of Phi Beta Kappa and of Sigma Xi and an honorary member of the Royal Agricultural and Horticultural Society of India, of the Pennsylvania Horticultural Society and of the School Garden Association. He served as president of the Botanical Society of America; of the Torrey Botanical Club, of the National Institute of Social Sciences and of the Twentieth

Century Club of Brooklyn. An active member of the International Flower Show Committee, he served also on several committees of the National Research Council. He was vice-chairman of the board of directors of the Horticultural Society of New York for many years, and for eight years a trustee of Adelphi College. He was a director of the Bermuda Biological Station for Research and of the New Jersey Federation of Shade Tree Commissions. In 1941 he received the Arthur Hoyt Scott Garden and Horticultural Award.

Few men have been able to combine, as Dr. Gager did, horticulture and botany, education and research, the applied and the scientific, civic interests and professional duties. A man of the highest ideals, Dr. Gager did not hesitate to oppose attitudes, ideas or trends which he considered unwise or ill considered or to correct erors in fact or statement in the fields with which he was familiar. Yet no worthy project related to his fields of interest failed to receive quick and generous support. His career illustrates how much can be done by a man of ability who devotes himself consistently and conscientiously to a subject he considers worthy of his utmost effort.

William J. Robbins

DEATHS AND MEMORIALS

Dr. Aleš Hrdlička, since 1910 curator of the Division of Physical Anthropology of the U. S. National Museum of the Smithsonian Institution, of which he had been in charge since 1903, died on September 5 at the age of seventy-four years.

Dr. H. Justin Roddy, formerly curator and professor of geology at Franklin and Marshall College, died on September 4 at the age of eighty-seven years. Dr. Roddy joined the faculty of Franklin and Marshall College in 1922. He had previously been a member of the faculty of the Millersville State Teachers College.

Dr. Arthur Pehr Robert Wadlund, professor of physics at Trinity College, Connecticut, died on September 1 at the age of forty-seven years.

Dr. Thomas Gilbert Pearson, president emeritus of the National Association of Audubon Societies, died on September 3 at the age of sixty-nine years. He resigned from the presidency of the association in 1934, after serving for fourteen years. He had previously been secretary and executive officer of the society.

John K. Gore, mathematician, until 1934 president of the Prudential Insurance Company, died on June 22, at the age of seventy-nine years.

The death is announced of Dr. Willem A. J. M. Van Waterschoot van der Gracht, formerly inspector general of state mines in the Netherlands, who had been connected with ore and petroleum companies in the United States and Canada.

The life and work of Alexander Wilson, author of the first American ornithology, will be the subject of the October number of *Frontiers*, the magazine of the Academy of Natural Sciences of Philadelphia. On the evening of October 20, Dr. Cornelius Weygandt will address members of the academy and guests on the place of Wilson in American life, science and art. On account of limited editions imposed by the war, those wishing to have the special Wilson number of *Frontiers*, which will appear on September 15, should apply at once.

SCIENTIFIC EVENTS

SCIENTIFIC RESEARCH IN GREAT BRITAIN

In the British House of Lords on July 20 there was a continuation of the debate on a motion by Viscount Samuel calling attention to the need for the further expansion of scientific research. Lord Dawson pointed out that "It was difficult to overstress the importance where science was concerned—and this applied equally to medicine—of preventing the enmeshment of any research body in the close entanglement of a Government department. One of the chief reasons why these research bodies should receive further support was that they succeeded in combining good order in the work of men of ability with freedom for scientific investigation."

Lord Cherwell said in part "that the importance, from the economic point of view, of fostering pure fundamental research could not be overlooked.

The Government recognized that pure research must be, in a large measure, its responsibility and must be done at the universities; but naturally, they also wished to encourage industry to spend money on pure research. It was the Government's policy and intention to increase its aid for research, and it would welcome any developments of industry in a similar direction. The treatment of scientists in the Civil Service had been mentioned, and he frankly admitted that the Civil Service had not hitherto shown due regard for the contribution scientists were making to the nation's welfare. This matter had now been reviewed, and an investigation had been in progress to make sure that the conditions of service, pay and prospects of Government scientific employees compared favorably with those on the administrative side. He hoped that a definite announcement on these reforms might be made before long. There were probably not more than a few dozen physicists in Great Britain capable of evolving and developing new applications of, say, the various radio devices on which success in this war very largely depended. Every one would agree that it was an anomaly to pay them on lower scales than men of equal educational status who, because they had distinguished themselves in what were usually called "humane" subjects, were often given war jobs of much higher status and pay than the scientist.

THE CANADIAN AIRCRAFT STANDARDS TECHNICAL COMMITTEE

IT is reported in *Industrial Standardization* that an Aircraft Standards Technical Committee has been organized by the Canadian Engineering Standards Association to set up standards and simplified practices for materials and component parts used in the construction of aircraft in Canada and to coordinate these standards with the standards used in the United States, Great Britain and Australia. Three meetings of the committee have been held.

Cooperative arrangements have been made by the committee with the British Air Commission, the U. S. Aeronautical Board, the U. S. Aeronautical Chamber of Commerce, the U. S. Army and Navy Air Corps, the National Aircraft Standards Committee, the Society of Automotive Engineers and other organizations working on aircraft standards in the United States. The functions of each of the important organizations in the aircraft standards field were discussed in detail at the August meeting in order that all representatives present at the meeting might have a clear picture of the general program.

The work of the Aircraft Standards Technical Committee is to include adoption of standards, the issuing of bulletins on conservation, the collection of bulletins and information from standardization organizations in other countries, and the exchange of information with such organizations. Examples of conservation and of standardization have been prepared.

The committee, which will function as a subcommittee of the Canadian Engineering Standards Association, is made up of representatives of the nine Canadian aircraft contractors, the Royal Canadian Air Force and the Department of Munitions and Supply, Aircraft Production Branch. In addition to the Air Force and the Munitions Department, those represented at the first meetings of the committee included Boeing Aircraft of Canada, Ltd.; Canadian Car and Foundry Company, Ltd.; Canadian Vickers, Ltd.; DeHavilland Aircraft, Ltd.; Fairchild Aircraft Ltd.; Federal Aircraft Ltd.; Fleet Aircraft, Ltd.; Noordwyn Aviation, Ltd., and Victory Aircraft, Ltd.

THE LEWIS CASS LEDYARD, JR., FELLOWSHIP OF THE SOCIETY OF THE NEW YORK HOSPITAL

THE Lewis Cass Ledyard, Jr., fellowship was established in 1939 by a gift from Mrs. Ruth E. Ledyard, in memory of her late husband, Lewis Cass Ledyard, Jr., a governor of the New York Hospital. The income, amounting to approximately $4,000 annually, is awarded to an investigator in the fields of medicine and surgery or in any closely related field. This amount is applied as follows: $3,000 as a stipend and, approximately, $1,000 for supplies or expenses of the research. In making the award, preference is given to younger applicants who are graduates in medicine and who have demonstrated fitness to carry on original research of high order. The recipient of this fellowship will be required to submit reports of his work under the fellowship, either at stated intervals or at the end of the academic year; and when the result of his work is published he will be expected to give proper credit to the Lewis Cass Ledyard, Jr., Fellowship. The research work under this fellowship is to be carried on at the New York Hospital and Cornell University Medical College. The fellowship will be available on July 1 at the beginning of the academic year. Applications for the year 1944–45 should be in the hands of the committee by December 15. It is expected that the award will be made by March 15, 1944.

Application for this fellowship should be addressed to The Committee of the Lewis Cass Ledyard, Jr., Fellowship, The Society of the New York Hospital, 525 East 68th Street, New York, N. Y.

GRANTS FOR RESEARCH IN APPLIED PSYCHOLOGY

THE Psychological Corporation has made the following grants of $250 each for research in applied psychology:

Clark, Ruth Millburn, University of Southern California. A Method of Administering and Evaluating the Thematic Apperception Test in Group Situations.

Grossnickle, Louise T., University of Chicago. A Factorial Analysis of the Merrill-Palmer Preschool Test on Two Age Groups, 31–33 and 49–51 months.

Murray, Elsie, Cornell University. Variation in Hue Sensitivity in Normal and Aberrant Cases: Test Devices.

Nahm, Helen, University of Minnesota. Evaluation of Some of the Outcomes of the Nursing School Curriculum.

Odoroff, Maurice E., University of Minnesota. A Genetic Analysis of Reactions of Delinquent and Non-delinquent Boys to Words Included in Certain Tests of Emotional Development.

Reichard, Suzanne K., Columbia University. The Age Factor in the Development of Specific Mental Abilities.

Roth, Harold F., University of Minnesota. An Analysis of Production Records in a Selected Manual Operation.

Samelson, Babette F., Radcliffe College. The Relationship between Race Prejudice and Insecurity.

Sargent, Helen D., Northwestern University. An Application of Projective Principles to a Paper and Pencil Personality Test.

Members of the Grants-in-Aid Committee are Harry D. Kitson, A. T. Poffenberger, Rose G. Anderson, George K. Bennett, Walter R. Miles, *Chairman*, and Albert D. Freiberg, *Secretary*.

THE "B-COMPLEX" AWARD OF MEAD JOHNSON AND COMPANY

NOMINATIONS are solicited for the 1944 award of $1,000 established by Mead Johnson and Company to promote researches dealing with the B-complex vitamins. The recipient of this award will be chosen by a committee of judges of the American Institute of Nutrition.

The award will be given to the laboratory (nonclinical) or clinical research worker in the United States or Canada who, in the opinion of the judges, has published during the previous calendar year January 1 to December 31 the most meritorious scientific report dealing with the field of the "B-complex" vitamins. While the award will be given primarily for publication of specific papers, the judges are given considerable latitude in the exercise of their function. If in their judgment circumstances and justice so dictate, it may be recommended that the prize be divided between two or more persons. It may also be recommended that the award be made to a worker for valuable contributions over an extended period, but not necessarily representative of a given year. Membership in the American Institute of Nutrition is not a requisite of eligibility for the award.

To be considered by the committee, nominations for this award for work published in 1943 must be in the hands of the secretary by January 10, 1944. The nominations should be accompanied by such data relative to the nominee and his research as will facilitate the task of the committee in its consideration of the nomination.

ARTHUR H. SMITH,
Secretary

AMERICAN INSTITUTE OF NUTRITION

THE NUTRITION FOUNDATION

ACCORDING to a statement made by George A. Sloan, president of the Nutrition Foundation, the sum of $237,000 is now being contributed annually by 37 food and related manufacturers to the foundation in support of basic research in the science of nutrition.

It was also announced that Abbott's Dairies of Philadelphia and the American Lecithin Company of New York have become sustaining members of the foundation. C. R. Lindback, president of Abbott's Dairies, and Adrian D. Joyce, chairman of the American Lecithin Company, have become members of the board of trustees, which consists of 11 representatives from the public and 33 from industry.

Mr. Sloan stated that the Nutrition Foundation is now supporting 70 basic studies in 38 institutions in the United States and Canada. On the recommendation of the Scientific Advisory Committee of the foundation, grants-in-aid amounting to $302,840 have been paid to these institutions since the organization of the foundation in 1942.

Mr. Sloan states that:

> Research studies having an immediate bearing on the war emergency, in which the foundation is working in close cooperation with governmental authorities, include the effects of cooking, dehydrating, freezing and storing on the nutritive quality of vegetables and meats; the influence of dietary factors in healing of bone fractures; the relation of vitamins to susceptibility to infection; the effects of military environment on nutrition; the value of nutrition in reducing the incidence of shock following injury and exposure and treating individuals suffering from shock; nutrition and resistance to fatigue; and the utilization of the proteins and minerals of the soybean.
>
> Other research studies of the foundation relating to public health include clinical nutritional deficiencies; types and degrees of malnutrition; dental caries; liver function; rheumatic fever; comparative studies of the nutrients in human and cow's milk under specific dietary conditions; increasing the nutritive value of vegetable foods; and studies of protein, amino acids, minerals (calcium and iron) and vitamins.

THE FIFTIETH ANNIVERSARY OF FIELD MUSEUM OF NATURAL HISTORY

FIELD MUSEUM OF NATURAL HISTORY, born with the issuance of its charter by the Secretary of State of Illinois on September 16, 1893, will soon celebrate its fiftieth anniversary.

A special exhibit illustrating some of the main developments in the museum's first fifty years will be opened to the public at 9 A.M. on Thursday, September 16. A preview and reception for the 4,300 members of the museum, the press and invited guests, representing civic, educational, scientific and other circles, will be held at 8:30 on the evening of September 15. President Robert Maynard Hutchins, of the University of Chicago, will be the principal guest speaker. He will be followed by Dr. Albert Eide Barr, director of the American Museum of Natural History, New York, and Dr. Franklin Bliss Snyder, president of Northwestern University. Dr. Osgood, "dean of the staff," will introduce the speakers. Brief addresses will be made also by President Field, Marshall Field, Orr Goodson, acting director, and possibly by the director, Colonel Clifford C. Gregg, if his army post with the Tank Destroyer Center at Camp Hood, Texas, is able to grant him leave to attend.

Concurrent with the golden anniversary exhibit will be the opening of the museum's first International Photographic Exhibit under the title "Lenses on Nature." This salon of pictures, selected from entries submitted by contributors in all parts of this country and many foreign countries, will continue through

November 15. The pictures will be chosen by a jury of selection composed of Dr. Fay-Cooper Cole, chairman of the department of anthropology of the University of Chicago; Valentino Sarra, professional photographer of New York and Chicago; C. R. Brockhausen, past president of the Chicago Camera Club; J. P. Wahlman, president of the Fort Dearborn Camera Club; Samuel Insull, Jr., museum trustee; and Dr. B. E. Dahlgren, chief curator of botany. Ribbons will be awarded to photographs considered as possessing special merit.

Beginning on September 16, and continuing as long as a limited supply lasts, the first few thousand adult visitors coming to the museum for the fiftieth anniversary will receive copies of "Fifty Years of Progress," a special illustrated 40-page issue of *Field Museum News,* the monthly periodical published for members of the museum. This issue is devoted entirely to a summary of the history of the museum to date and to a forecast of its future. Contributors include Stanley Field, president of the museum since 1909; Orr Goodson, acting director; Dr. Paul S. Martin, chief curator of anthropology; Dr. B. E. Dahlgren, chief curator of botany; Henry W. Nichols, chief curator of geology; Karl P. Schmidt, chief curator of zoology; John R. Millar, curator of the N. W. Harris Public School Extension; Miriam Wood, chief of the James Nelson and Anna Louise Raymond Foundation lecture staff; Mrs. Emily M. Wilcoxson, librarian; Henry F. Ditzel, registrar; Dr. Wilfred H. Osgood, curator emeritus of zoology, and Dr. Wilfrid D. Hambly, curator of African ethnology. The book was produced under the managing editorship of H. B. Harte, public relations counsel.

SCIENTIFIC NOTES AND NEWS

DR. WALTER B. CANNON, professor emeritus of physiology at the Harvard Medical School, president of the recently formed American-Soviet Medical Society, organized to stimulate the exchange of medical information between the United States and the Soviet Union, was formally inducted at a reception given in his honor by the Soviet Embassy on August 12 as a member of the *Academy of Sciences of the Union of* Soviet Socialist Republics.

THE Chicago Section of the American Institute of Chemists on October 1 will give a testimonial dinner at the Morrison Hotel in Chicago, in honor of Dr. F. C. Koch, formerly chairman of the department of biochemistry of the University of Chicago, at present head of the Biochemical Division of the Research Laboratories of Armour and Company. Addresses will be made by Dr. Edward A. Doisy, of the School of Medicine of St. Louis University; Victor Conquest, director of research of Armour and Company; Dr. George K. K. Link, of the University of Chicago, and Dr. Koch.

THE twenty-fifth anniversary of the appointment of Dr. Gebhard Stegeman as professor of physical chemistry at the University of Pittsburgh was celebrated at a dinner in the Hotel Schenley on September 7, in connection with the convention in Pittsburgh of the American Chemical Society.

DR. ROBERT P. FISCHELIS, of Trenton, N. J., head of the chemicals, drugs and health supplies branch of the War Production Board, and a former dean of the New Jersey College of Pharmacy, has been awarded the Remington Honor Medal, conferred annually by the New York Branch of the American Pharmaceutical Association on "the man or woman who has done most for American pharmacy during the preceding year or during a longer period of outstanding activity and fruitful achievement."

THE Baly Medal of the Royal College of Physicians, London, has been awarded to Dr. F. C. Bartlett, professor of experimental psychology at the University of Cambridge, for his work in the science of physiology and in particular for his contributions to experimental psychology; the Gilbert Blane Medal to Surgeon-Commander D. P. Gurd, and the Murchison scholarship to Dr. Bruce Cruickshank.

DR. FLORENCE RENA SABIN, formerly of the Rockefeller Institute for Medical Research, has been made an honorary national commander of the Women's Field Army of the American Society for the Control of Cancer.

PROFESSOR TREVOR KINCAID is retiring as chairman of the department of zoology and physiology of the University of Washington, Seattle, having held the position since 1901. Dr. Arthur Svihla has been selected as his successor.

DR. DAVID L. SOLTAU, formerly coordinator of the engineering, science and management war-training program at the University of Southern California, has been appointed professor of physics and head of the department at the University of Redlands. He took up his work on June 15.

DR. JOHN N. COOPER, of the department of physics of the University of Southern California, has been appointed assistant professor of physics at the University of Oklahoma.

DR. P. L. KNUDTZEN has been appointed acting dean of the College of Dentistry of Baylor University at Dallas, to succeed the late Frederick W. Hinds, who died on June 4. Despite the removal of the College of Medicine of Baylor University to Houston, it is expected that the College of Dentistry will continue to be conducted at Dallas.

Dr. Schuichi Kusaki, who for the last six years has worked successively at the Massachusetts Institute of Technology, the University of California and the Institute for Advanced Study at Princeton, has received a temporary appointment as instructor in physics at Smith College.

Dr. Charles A. Doan, professor of medicine and director of medical research at the College of Medicine of the Ohio State University, has been elected president of the Ohio Public Health Association.

Dr. Ivan G. Howe, Allegany County welfare commissioner, has been appointed director of the Bureau of Animal Industry of the New York State Department of Agriculture. He succeeds Dr. Ernest T. Faulder, who has retired.

Dr. J. Allen Scott, associate director of the Division of Malaria and Hookworm Service of the Georgia Department of Public Health, has become senior statistician of the Division of Vital Statistics of the U. S. Bureau of the Census, Washington, D. C.

Dr. Douglas Parry, clinical psychologist at Syracuse University, has been appointed clinical psychologist in the Bureau of Child Guidance at the Southern Illinois Normal University at Carbondale.

Dr. John S. Karling, associate professor of botany at Columbia University, has leave of absence to enable him to undertake work with the Rubber Development Corporation at Miami, Fla.

Dr. Julius Berger, for the past three years research associate at Connecticut College on a Rockefeller grant to Professor George S. Avery, Jr., has joined the biochemical staff of the Hoffmann-La Roche Chemical Company.

Dr. Guy M. Everett, of the department of physiology of the Medical School of the University of Maryland, has become associated with the department of pharmacology of Abbott Laboratories, North Chicago.

Bakelite Corporation, a unit of Union Carbide and Carbon Corporation, has announced the appointment of Dr. Raymond Charles Bacon to the research and development laboratories in Bloomfield, New Jersey.

Thomas S. Nichols, consultant of the Chemical Division of the War Production Board, is in London on special assignment with the Harriman mission, handling problems connected with the Lend-Lease program.

Lindon J. Murphy, associate professor in the Engineering Extension Service at Iowa State College, has been given leave of absence to accept a commission as major with the U. S. Public Health Service. He will work with the sanitary engineers of the service.

Dr. C. E. Ronneberg, chairman of the division of physical sciences of Herzl City College, Chicago, has been granted leave of absence for the duration of the war. He is serving in the grade of major on the faculty of the Chemical Warfare School, Edgewood Arsenal, Md.

Professor Henri Laugier, professor of general physiology at the Sorbonne, director of science at the University of Montreal, has been appointed by the French Committee of National Liberation chancellor of the Academy of Algiers, and has received jurisdiction over all French education in North Africa. From 1937 to 1940 Dr. Laugier was in charge of the Central National Scientific Institute of Research at the Ministry of the Naval Education in Paris. He was also chief of cabinet to the Minister of Education.

Dr. Cecil Henry Desch, from 1932 to 1939 superintendent of metallurgy of the British National Physical Laboratory, previously from 1920 to 1931 professor of metallurgy at the University of Sheffield, has become director of the British firm of Richard Thomas and Company. He will advise the company on matters of scientific research.

Sir Henry Tizard, president of Magdalen College, Oxford, until recently chairman of the British Aeronautical Research Committee, has resigned from the Air Council and the Aircraft Supply Council of the Ministry of Aircraft Production. He will leave England on a special mission for two or three months.

Dr. Liberty Hyde Bailey, of Cornell University; Dr. U. P. Hedrick, formerly director of the New York State Experiment Station at Geneva; Dr. M. B. Davis, Dominion horticulturist of Ottawa; W. S. Blair, of the Nova Scotia Experiment Station at Kentville, and other leaders in the field of horticulture will take part in the twenty-fifth annual meeting of the New York State Fruit Testing Cooperative Association to be held at the Experiment Station at Geneva on September 16. The history of the association will be reviewed by Dr. Hedrick and L. F. Strickland, of Lockport, N. Y., two of its first directors; W. C. Stone, of Springfield, Vt., first secretary-treasurer of the association, and Professor R. D. Anthony, of the Pennsylvania State College, formerly horticulturist at Geneva. Dr. Bailey, Dr. Davis and Mr. Blair will discuss the importance of new varieties to the fruit-growing industry, and the desirable and undesirable characteristics of recent introductions, many of which will be on display. Dr. W. S. Whitehouse, in charge of plant introduction for the U. S. Department of Agriculture, and Dr. W. W. Aldrich, also of the Federal Department, will outline the government's fruit-breeding program with particular reference to new introductions that offer possibilities in fruit-breeding work.

It is reported in the *Journal* of the American Dental Association that C. Willard Camalier, chairman of the War Service Committee, has announced that the War Manpower Commission has approved of a new committee on dental education to act as adviser to the directing board of the Procurement and Assignment Service. The appointment of two additional members to represent dental examiners to the Committee on Dentistry of the Procurement and Assignment Service for Physicians, Dentists and Veterinarians was also announced. The committee will concern itself with developments arising out of the Army and Navy Specialized Training Program, as well as with the training of students for civilian practice. Members of the committee are J. Ben Robinson, dean, Baltimore College of Dental Surgery, University of Maryland; Dr. Harlan H. Horner, executive secretary, Council of Dental Education of the American Dental Association; Carl O. Flagstad, secretary, American Association of Dental Schools; Wendell D. Postle, dean, College of Dentistry, the Ohio State University; Bert L. Hooper, dean, College of Dentistry, University of Nebraska.

It is stated in *Nature* that the British Ministry of Food has, by arrangement with the Department of Scientific and Industrial Research and the flour milling industry, taken over for the period of the war the extensive laboratories at St. Albans which were previously occupied by the Research Association of British Flour Millers. The Ministry will have the advantage of the use of these laboratories and the existing staff for the consideration of all food research problems, but they will continue to be used in the main for specialized work connected with cereals and cereal products. The laboratories will, in future, be known as the Cereals Research Station of the Ministry of Food. Dr. P. Moran, who was previously director of research to the Research Association of British Flour Millers, has been acting as deputy scientific adviser to the Ministry since June, 1940. In March last he was appointed, in addition, director of research in the Ministry of Food. In this latter capacity he will direct the work at St. Albans. From June 1, the date on which the transfer took place, the entire control and direction of the laboratories passed to the Ministry of Food.

DISCUSSION

SCIENTIFIC RESEARCH BY THE DEPARTMENT OF AGRICULTURE

Under date of July 26 I called the attention of Dr. Karl T. Compton to the fact that the material in his Pilgrim Trust Lecture, "Organization of American Scientists for the War," appearing on page 73 of Science, for July 23, 1943, contained certain errors relative to work carried on by the Department of Agriculture. He very kindly replied, in a letter of July 31, 1943, in which he expressed regret that, despite his efforts to clear and attain full accuracy, misstatements were made. He also wrote:

> I wonder if you would feel like submitting to the editor of Science a brief comment on the subject, in which you would call attention to such errors of statement or implication as may have concerned the Department of Agriculture in my lecture. I should welcome it if you should wish to do so, and it would certainly be worth while to get the record straight promptly.

In the part of his lecture to which I made reference Dr. Compton stated that the scientific research carried on by the Department of Agriculture was quite largely spread through a great number of agricultural experiment stations distributed in the various states, with which it operated cooperatively. He also said: "Most of the bureaus in Washington are primarily of an administrative character, but there are several which also conduct centralized research, as, for example, the Bureau of Chemistry and Soils and the Food and Drug Administration."

The facts are that the department's initial work was in the field of scientific research, the introduction of valuable plant species, entomology, botany, chemistry, meteorology, and so on. Its first bureau, the Bureau of Animal Industry, was created by act of Congress of May 29, 1884, and has carried on and still performs very distinguished research in the field of animal diseases, of the breeding, feeding and management of domestic animals and related subjects.

On March 2, 1887, an act was passed which authorized the establishment, under the direction of the land-grant colleges, of stations in each state to conduct agricultural experimentation. The Office of Experiment Stations was established in the Department of Agriculture, in 1888, to act as a staff agency to administer Federal grants involved in this and subsequent supplementary legislation. This work includes the evaluation and approval of research projects, proposals for new projects, project revisions, annual research programs and budget allotments of the state experiment stations, as well as the coordination of their researches with similar or related investigations carried on by the department itself. This is the department's sole agency with the administrative functions mentioned.

On December 13, 1941, a major reorganization of the Department of Agriculture was announced to streamline it for the war effort. An Executive Order dated February 23, 1942, validated this reorganization. At that time seven of the old-line scientific bureaus and agencies, concerned largely with research work, were combined to form the Agricultural Research Administration. Included also were the four large Regional Research Laboratories, authorized in 1938, and established at Peoria, Ill., Albany, Calif., Philadelphia, Pa., and New Orleans, La.; the nine Bankhead-Jones laboratories for research on special agricultural projects; and the Beltsville (Md.) Research Center.

In February, 1943, due to an internal reorganization within the Agricultural Research Administration, some of the bureaus were re-named. Their names will provide a sufficient indication of the fields of research they cover for present purposes and are now as follows: Bureau of Animal Industry, Office of Experiment Stations, Bureau of Entomology and Plant Quarantine, Bureau of Human Nutrition and Home Economics, Bureau of Dairy Industry, Bureau of Plant Industry, Soils, and Agricultural Engineering, and the Bureau of Agricultural and Industrial Chemistry. The work of the Regional Research Laboratories is now closely integrated with the last.

As a result of Presidential reorganization plans announced in 1939 and 1940, the Weather Bureau was transferred to the Department of Commerce, the Food and Drug Administration to the Federal Security Agency, the Bureau of Public Roads to the Federal Works Agency, and the Bureau of Biological Survey to the Department of the Interior, where it became part of the Fish and Wildlife Service.

In addition to the above-mentioned agencies in the Agricultural Research Administration, the department carries on considerable scientific research in the Forest Service and in the Soil Conservation Service. The former does research in twelve forest and range experiment stations, and in the well-known Forest Products Laboratory at Madison, Wis. The latter conducts investigations into the character, cause and effect of soil erosion and water depletion, and develops methods of soil and water conservation in cooperation with state agricultural experiment stations. Finally, the Bureau of Agricultural Economics is the central statistical and economic research agency of the department, and has done outstanding work in the fields of social and economic science.

T. SWANN HARDING,
Sr. Information Specialist
U. S. DEPARTMENT OF AGRICULTURE

A TEA PREPARED FROM NEEDLES OF PINE TREES AGAINST SCURVY

IN the issue of SCIENCE for August 6, 1943, Maurice Donnelly calls attention to the work of B. Shishkin concerning the use of needles of ordinary pine trees against scurvy. Francis Parkman is quoted as having published the beneficial effect of a decoction of evergreen on scurvy.

The beneficial effect of this substance was discussed in an article of Dr. Walter Tobler, now in Bern, Switzerland, who studied scurvy in the children's clinic of the University of Vienna after the first World War. His paper is published in the *Zeitschrift fuer Kinderheilkunde* (Vol. 18, pp. 63–158, 1918). He found the publication of Lind, "Treatise about Scurvy," (Riga and Leipzig, 1775, translated from the second edition (English) by Petzold).

In the war between Sweden and Russia (most likely the march of Charles XII into the Ukraina in the winter of 1708/09) almost all soldiers of the Swedish army became incapacitated through scurvy. But the further progress of the disease was stopped, as according to the advice of Erhenius, the royal physician, a tea prepared from pine needles was used. Even the most severe cases were cured and soldiers up to that moment free from scurvy were protected. This remedy became therefore very famous and the pine tree was called afterwards *Pinus Antiscorbuticus*.

Lind quotes further proofs for the beneficial effect of pine needles and needles of other conifers. Later the cones and even the green bark of these trees were used against scurvy and not only in form of tea but also in form of pine-beer. Lind states with enthusiasm: "If one takes a few bags filled with Pine branches on an ocean trip, one may prepare this 'marvellous drink' at any time. The drink may be prepared by letting the pine needles ferment in wine or beer."

One of the first antiscorbutic remedies in Europe was wine in which Vermouth was put in and boiled. But Lind states that experience teaches that "real" pine-needle beer better than anything else not only prevents scurvy but it is also a very effective curative remedy.

Tobler points out that the richness of woods in pine trees in Europe gives the people the consolation that they possess an excellent remedy against scurvy. Wine and beer are not necessary.

Tobler prepared the drink by pouring boiling water over the crushed needles, letting the extracting proceed until the tea obtained an exquisite aroma of pine needles. The taste of the tea is very pleasant so that even a sensitive palate will not refuse it. Tobler used the tea and was enthusiastic about it. I took it myself and found the drink very nice.

Children went with knapsacks into the pine woods in order to collect the pine needles, and each child received one cup of pine-needle tea daily.

BÉLA SCHICK

17 EAST 84TH STREET,
NEW YORK, N. Y.

VITAMIN C IN EVERGREEN-TREE NEEDLES[1]

THE identity of the tree that cured Jacques Cartier's men of scurvy when they wintered near Quebec in 1535–6 will always remain in doubt, as the Iroquois name "annedda" (ameda) denotes simply an evergreen tree. Many of Champlain's men died of scurvy when he wintered near the same place 73 years later, in 1608–9. Champlain had heard something of Cartier's miraculous "annedda," but he sought it in vain, probably because he did not know it was a tree—he speaks of it as "l'herbe appelée Aneda"—and because since Cartier's time the Iroquois population had moved away and the Algonquins who had replaced them could not tell him the meaning of the word.

Almost every editor of the Voyages of the early French explorers, beginning with Hakluyt in 1600, has proposed a different tree for annedda. The suggestions have been sassafras, *Sassafras varifolium;* white pine, *Pinus strobus;* balsam fir, *Abies balsamea;* spruce, *Picea sp.;* and hemlock, *Tsuga canadensis.* Sassafras is Hakluyt's wild guess; the northern limit of the tree is far south of Quebec. Of the others, spruce and hemlock are the more likely candidates. There is evidence that the inner bark of white spruce, *Picea canadensis,* which is known to be very rich in ascorbutic acid, was used in Indian medicine. It was an ingredient in a "spring tonic" compounded by white settlers in Ontario who had been told of its virtues by the Indians.[2] Hemlock, however, seems to have been in far greater use among the natives than any of the other conifers. It served them as food, drink and medicine. To give a few references: F. W. Waugh ("Iroquois Foods and Food Preparation," Ottawa, 1916), "Take the leaves, steep, sweeten with maple sugar, and eat with corn bread or at meals." John Stewart ("An Account of Prince Edward Island in the Gulph of St. Lawrence," London, 1806), ". . . and the tips yield a medicine which has been found very powerful in scorbutic complaints." L. H. Morgan ("Houses and Home Life of the American Aboriginies," Washington, 1881), "A favorite beverage was made from the tips of hemlock boughs boiled in water, and seasoned with maple sugar." And Thoreau relates that his Indian guide in the Maine woods gave him hemlock tea for breakfast. He adds the characteristic remark, "and we were not obliged to go as far as China for it."

CHARLES MACNAMARA

ARNPRIOR, ONT., CAN.

SCIENTIFIC BOOKS

PSYCHOLOGY FOR THE FIGHTING MAN

Psychology for the Fighting Man. Prepared for the fighting man himself by a committee of the National Research Council with the collaboration of Science Service as a contribution to the war effort. Washington: *The Infantry Journal.* 1943.

IT is a truism that the popularization of science is not easy. Real scientific publications are never needlessly complex except when written by pedants or by scientists whose minds are not quite first-class. Of course the non-scientifically trained reader can not always follow good technical writing becase he is in respect to the science in question a layman and has not mastered its concepts. The duty of the true popularizer in science is to make the specific problems dealt with as clear as possible to the non-professional reader. It is an advantage also in popular writing to relate these problems in some way when possible to the ordinary experience of everyday life in which the non-technical reader is interested. The popularizer may then describe in simple and clear expository prose the solutions of the problems that have been raised. The intermediate description of special methods, particularly those that are mathematical, and the technical evaluation of the evidence of the science must in many cases be omitted or only most briefly presented.

The book before us is just such a true popularization. It is a most successful one. The common experience to which it is everywhere related is military life. How did this book come into being? The need for a presentation of real, modern, scientific psychology so that it could be understood by the average American enlisted man was early recognized. The way of achieving this end was discussed at a number of meetings of the Emergency Committee or "war cabinet" in psychology of the Division of Anthropology and Psychology of the National Research Council. Finally a committee was appointed to prepare the present book. The chairman of the committee and editor-in-chief of the volume was Professor E. G. Boring, of Harvard University.

Many psychologists contributed chapters or sections for the book. Much of this material as originally presented was not "popular" in the sense described in the first paragraph of this review. Therefore all the pages submitted were almost entirely rewritten by Professor Boring and Miss Marjorie van de Water of Science Service. Colonel E. L. Munson, Jr., a member of the committee, also read the complete manuscript, and Colonel Joseph I. Greene, editor of *The Infantry Journal,* made many suggestions concerning the military aspects of the book during the whole period of writing and rewriting. Amazingly enough, in spite of the complex relationship of scientists and committees associated with the book, Dr. Boring's untiring energy was able to drive the whole enterprise through in relatively few months so that already more than a hundred thousand copies of the volume have been put on sale in bookstores, drugstores and post exchanges throughout the country and in other countries where our troops are located.

---

[1] SCIENCE, August 6, 1943.

[2] Personal letter from Professor R. B. Thompson, Department of Botany, University of Toronto.

The table of contents of the book is as follows:

I: Psychology and Combat
II: Sight as a Weapon
III: Seeing in the Dark
IV: Color and Camouflage
V: Hearing as a Tool in Warfare
VI: Smell—A Sentry
VII: The Sense of Position and the Sense of Direction
VIII: The Right Soldier in the Right Job
IX: Training Makes the Soldier
X: How the Army Teaches
XI: Efficiency in the Army
XII: Heat, Cold, Oxygen and Stimulants
XIII: Morale
XIV: Food and Sex as Military Problems
XV: The Soldier's Personal Adjustment
XVI: Leadership
XVII: Mobs and Panic
XVIII: Differences Among Races and Peoples
XIX: Rumor
XX: Psychological Warfare

The chapter headings just enumerated give some impression of the wide areas of psychology treated in the volume.

The new book must be read by the professional scientist with the memory ever before him of the basic purpose of its pages. The statement that light "becomes visible when its strikes the retina of your eye" is useful in the frame of reference of this book, but obviously this is not a statement which would be appropriate in a treatise on physiological optics. Similar sentences could be taken from many pages of the book.

The chapters which deal with topics in social psychology may be less convincing to the popular as well as to the scientific reader than are the chapters that deal with areas in which quantitative psychology is better established.

A reviewer should not disclose himself as a book salesman, but in the case of the present volume and the present reviewer this rule is here and now violated. "Psychology for the Fighting Man" is a remarkable bargain. For twenty-five cents a modern, clearly written exposition of scientific psychology as it is applied to the task of warfare and incidentally to many tasks of the working world is now offered in a neat well-printed pocket edition. The reason that this book can be sold for such a small sum is that the authors, the editors and the publishers have all undertaken the preparation of this work as a war service. The small royalties on the book are transferred to the National Research Council for research. The Infantry Journal Company, publishers of the volume, is a nonprofit organization.

Certainly every psychologist should read this volume from cover to cover. Scientists in other fields will also profit by reading its clear pages. Recently on an overnight train trip I lent my copy of this book to a distinguished engineer. In the morning he greeted me with the statement: "I am going to send copies of this book to my two sons who are in the service and tell them to read every page. It will be of great value to them." It is not too much to say that "Psychology for the Fighting Man" may actually save the life of some of its readers. It will almost certainly raise the morale of all who read it. The reason that it will have this direct result is that it will help every soldier who reads it to understand and use more effectively those most complicated "instrumentalities of warfare," his own human reactions.

Surely those whose self-sacrificing work has made this remarkable book possible deserve the full gratitude of all their American scientific colleagues.

LEONARD CARMICHAEL,
Chairman, Division of Anthropology and Psychology, National Research Council
TUFTS COLLEGE

FUNDAMENTALS OF IMMUNOLOGY

Fundamentals of Immunology. By WILLIAM C. BOYD. xiv + 446 pp. 45 figs. Interscience Publishers, Inc. 1943. $5.50.

THE author writes this book with the sound belief that it is well for students to spend the too limited time available for the special subject immunology in acquiring the basic principles, "on the assumption that application of them will then not be difficult." "This book is intended for the beginner" without assuming any previous knowledge of the subject on his part, but it is hoped that it will be useful, too, to the professed immunologist. However, in the reviewer's opinion, this is not the book for elementary students but rather for advanced students and research workers.

The book is written as far as possible from the point of view of the chemist, without requiring any very extensive knowledge of chemistry. The historical recapitulation of the development of discoveries and theories has been avoided. Instead, the author plunges straight into what is known and thought to-day. Selected references are given in support of statements and from them the reader can trace the question further if he so desires. All this is well done and the scheme is attractive.

It is a worth-while and important book, coordinating a multiplicity of complex evidence with a direct simplicity and it will undoubtedly be useful to the immunologist engaged in research and teaching. But it would be delightful could it be believed that the average medical student could read this book with understanding, especially Chapter VI on "Antibody-Antigen Reactions."

This book can not supplant such books as Bordet's "Traité de l'Immunité" and Topley's "Outline of Immunity" but it is a very important supplement to them. The subject-matter undertaken is too large to be uniformly covered by a book of this size and by the experience of a single author, so it is to be expected that readers with particular interests will find disappointments. The fields in which the author has contributed so importantly are most exhaustively and satisfactorily treated. Other sides of the subject are not always balanced and some are not sufficiently comprehensive.

For example, though active immunity claims more attention than passive immunity throughout the book, the influence and importance of the antigenic character of antibody globulin in therapeutic applications of passive immunity is neglected. In fact, immunity processes and happenings in the living body are not developed. On the whole the possibilities, contributions and failings of so-called antigenic analysis of the bacteria are not convincingly presented and this leaves a feeling of lack of sympathy. Of the 21 pages of Chapter IV ("Cell Antigens") rather less than half are devoted to bacteria, whereas almost the entire 22 pages of Chapter V ("Blood Groups") deal with human blood groups only.

The strength of the book lies in the treatment of "Antibodies and Antibody Specificity" (Chapter II, 56 pages), "Antigens" (Chapter III, 26 pages), "Antibody Antigen Reactions" (Chapter VI, 84 pages) and "Human Blood Groups" (Chapter V, 22 pages). These chapters should earn for the book a place in every bacteriological laboratory and every biological library. They can be consulted with advantage for the information they contain, but, much more importantly, for the clarity with which they pose problems yet to be solved to further advance this progressive and very important subject. This is no mean virtue.

An important feature of this book, the abandonment of a chronological account of discoveries, experiments, theories and failures, deserves to be emphasized because it allows of a clear statement of present knowledge. There is, of course, a fascinating interest to the well-informed specialist in the history of the development of his subject and it has the undoubted value of giving perspective. No one can properly appreciate the weight and significance of an item of information without knowing the difficulties, disappointments and the toil which accompanied its revelation and the prejudices which had to be overcome to effect its acceptance. Nevertheless, the dragging of a student through the warp and woof of a confused pattern of failures and misinterpretations hinders his acquisition and appreciation of the proved truth. Dr. Boyd has steered clear of this and in doing so has exposed problems it is now important to solve. A book is not as valuable for the information it imparts as it is for the thought and investigation it provokes.

E. G. D. MURRAY

INORGANIC QUALITATIVE ANALYSIS

Inorganic Qualitative Analysis. By HAROLD A. FALES and FREDERIC KENNY. Illustrated. ix + 237 pp. D. Appleton-Century Company, *1943*. $2.65.

THIS book is designed for a one-semester course in which selected exercises in qualitative analysis serve to illustrate an introductory discussion of physicochemical principles, as applied to aqueous solutions. The first one hundred and fifty pages, together with some ten pages of supplementary exercises, are devoted to the theoretical discussions, which appear to be clear and thorough, and include many numerical problems. Another sixty pages present procedures for the detection of basic constituents; while analysis for acidic constituents is omitted, save that tests for four of the commonest acids are given on the last three pages. The procedures, according to standard methods, are arranged for semi-micro technique and should confront the student with few difficulties and require a minimum of laboratory time. All analyses assumedly begin with solutions prepared for the student, and complications, such as might arise from the presence of certain anions or of involatile organic matter, are thus avoided. There is also no mention of the preliminary operations which would be necessary in the case of a substance originally solid.

The book is well arranged and indexed, and is provided with lists of the necessary apparatus and reagents. It seems well suited to serve as text for a smoothly running course having the strictly limited objective described in the first sentence above.

D. P. SMITH

PRINCETON UNIVERSITY

SPECIAL ARTICLES

THE INFLUENCE OF METHYL CHALCONE OF HESPERIDIN ON THE TOXICITY OF MAPHARSEN IN RABBITS[1]

THE rapid treatment of early syphilis has attracted wide interest because of the benefit to the patient and the community from the completion of treatment in a matter of days. The toxicity of the methods used so far has been too high, however, to warrant their routine adoption.

The most serious toxic manifestation has been arsenical encephalopathy which, from published reports, has occurred in about 1.3 per cent. of patients given treatment with mapharsen.[2,3,4] The mortality has been about 0.3 per cent. The clinical findings range from headache and dizziness to convulsions and death. Elevation of the protein in the spinal fluid is regularly present. The pathological findings in man vary greatly. Hemorrhage may or may not be present, but by far the commonest finding is capillary damage. Goldstein and Stevenson[5] observed similar lesions in the brains of rabbits treated intensively with toxic doses of mapharsen. These findings suggest that the chief pathological alteration in arsenical encephalopathy is an increase in capillary permeability.

Beginning in 1940, we performed experiments in rabbits with numerous agents in an effort to prevent cerebral reactions from mapharsen, but none of these were successful. In 1936 Szent-Györgyi and his co-workers[6] suggested the existence of an anticapillary permeability factor which they called vitamin P, but the existence of this factor has not been definitely established. Goldfarb[7] employed an aqueous extract prepared from the whole lemon in the treatment of psoriasis, and suggested its use as a possible preventive of arsenical encephalopathy in patients receiving intensive treatment with mapharsen. As the result of this suggestion it was considered desirable to conduct preliminary experiments in rabbits with the lemon juice extract.

Lemon juice extract was fed to 18 New Zealand white male rabbits, each weighing approximately 2 kilograms, as follows: 10 cc of extract was administered by stomach tube once daily for two weeks prior to and during the administration of mapharsen. Mapharsen was injected intravenously twice daily for four days in doses of 8 milligrams per kilogram. Ten animals received mapharsen alone in an identical manner and served as controls. Survival rates in the two groups were: mapharsen and lemon juice, 28 per cent.; mapharsen alone, 10 per cent. This difference was not statistically significant.

Wawra and Webb[8] reported the isolation of a chalcone of hesperidin from lemon peel, which, in their preliminary experiments, appeared to decrease the fragility of capillaries and to prevent localized hemorrhages. Later a methyl chalcone was developed by the Research Department of the California Fruit Growers Exchange in order to prevent reversion of the chalcone to the closed ring of hesperidin. This product was made available to us, and three experiments were performed in which a total of 30 rabbits received methyl chalcone and mapharsen, while 30 received mapharsen alone. Methyl chalcone was injected intravenously in doses of 10 or 30 milligrams per kilogram once daily for 7 days prior to the administration of mapharsen and for the 4 days of mapharsen administration. Mapharsen was injected intravenously twice daily for 4 days in doses of 8 milligrams per kilogram. The results are shown in Table I. Survival rates, determined after three weeks of observation following the last treatment, were as follows: mapharsen and methyl chalcone, 90 per cent., mapharsen alone, 57 per cent. The difference in survival rate between the two groups is statistically significant, the relative deviate being 2.9.

TABLE I

Exper. No.	Methyl chalcone mg/kg per dose	Mapharsen + methyl chalcone				Mapharsen alone			
		Number of animals			Per cent. survival	Number of animals			Per cent. survival
		Total	Died	Survived		Total	Died	Survived	
1	10	5	1	4	80	5	3	2	40
2	30	15	1	14	93	10	4	6	60
3	30	10	1	9	90	15	6	9	60
Total		30	3	27	90	30	13	17	57

The influence of methyl chalcone of hesperidin upon the spirocheticidal effect of mapharsen was studied *in vitro*. Exudate containing abundant *Treponema pallidum* was obtained from patients with mucous membrane lesions of secondary syphilis. Dark field preparations were made by mixing equal volumes of the exudate and the solution to be tested by means of calibrated red blood cell pipettes. The following preparations were set-up:

---

[1] Supported in part by funds from the following agencies: The New York State Health Department, the Louis Livingston Seaman Fund, the California Fruit Growers Exchange Research Fund of New York University College of Medicine.

[2] L. Chargin, *Arch. Dermat. and Syph.*, 42: 248, 1940.

[3] E. W. Thomas and Gertrude Wexler, *Am. Jour. Pub. Health*, 31: 545, 1941.

[4] E. W. Thomas, Gertrude Wexler and B. Dattner, *Am. Jour. Syph., Gon. and Ven. Dis.*, 26: 529, 1942.

[5] D. H. Goldstein and L. D. Stevenson. To be published.

[6] A. Bentsath, S. Rusznyak and A. Szent-Györgyi, *Nature*, 138: 798, 1936. L. Armentano, A. Bentsath, T. Beres, S. Rusznyak and A. Szent-Györgyi, *Deutsche med. Wchnschr.*, 62: 1325, 1936.

[7] A. E. Goldfarb, *Arch. Dermat. and Syph.*, 43: 536, 1941.

[8] C. E. Warwa and J. L. Webb, SCIENCE, 96: 302, 1942.

(1) Saline + spirochete fluid.
(2) Chalcone 1: 1,333 + spirochete fluid.
(3) Chalcone 1: 1,333 + mapharsen 1: 4,000 + spirochete fluid.
(4) Mapharsen 1: 4000 + spirochete fluid.
(5) Mapharsen 1: 4000 + glutathione 1: 400 + spirochete fluid.
(6) Glutathione 1: 400 + chalcone 1: 1,333 + spirochete fluid.
(7) Glutathione 1: 400 + spirochete fluid.

All dilutions are final dilutions. All reagents were adjusted to pH 7 ±.

The results of six experiments are shown in the graph. The curves represent the average percentage of spirochetes retaining motility at the stated intervals. In the concentrations used, methyl chalcone did not inhibit the spirocheticidal action of mapharsen *in vitro*. Methyl chalcone appeared to exert independent spirocheticidal activity between 90 and 120 minutes after mixture with spirochetes. This effect could be abolished by glutathione.

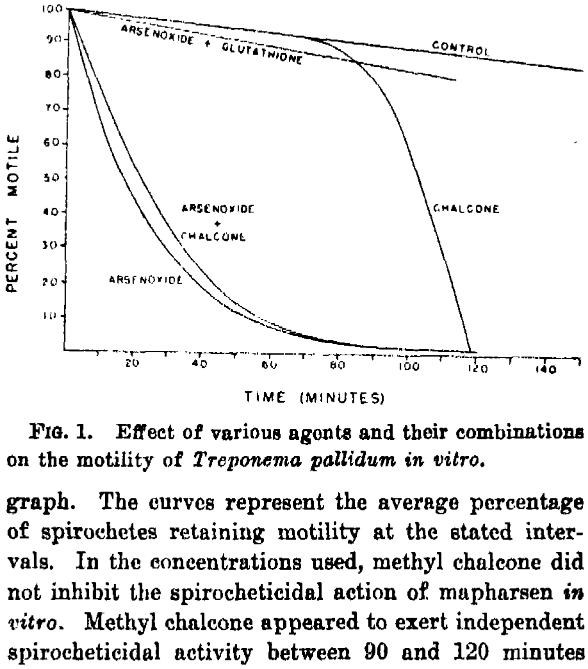


FIG. 1. Effect of various agents and their combinations on the motility of *Treponema pallidum in vitro*.

These preliminary observations indicate that the methyl chalcone of hesperidin may be capable of diminishing the toxic effects of mapharsen without inhibiting its spirocheticidal effect, and that it may possess independent spirocheticidal activity to a mild degree. Further studies are in progress to explore these possibilities.

DAVID H. GOLDSTEIN
ABRAHAM STOLMAN
ARTHUR E. GOLDFARB
DEPARTMENT OF PREVENTIVE MEDICINE,
COLLEGE OF MEDICINE, NEW YORK
UNIVERSITY, AND DEPARTMENT OF
DERMATOLOGY AND SYPHILOLOGY,
THIRD MEDICAL DIVISION,
BELLEVUE HOSPITAL

THE ANTIBACTERIAL EFFECT OF ENZYMATIC XANTHINE OXIDATION[1]

RAISTRICK and his colleagues[2] made the curious observation that an oxidase may display antibacterial activity. They had observed a bactericidal activity with certain protein fractions from *Penicillium notatum* which definitely was not attributable to the ether-soluble, low-molecular penicillin. Eventually this bactericidal effect was traced to glucose oxidase, a flavoprotein which catalyzes the reaction:

$$\text{glucose} + O_2 \longrightarrow \text{gluconic acid} + H_2O_2$$

The generated hydrogen peroxide was thought to be mainly, if not exclusively, responsible for the bactericidal effect of the enzymatic system.[3] The name, notatin, was suggested for this enzymatic bactericide. Simultaneously two similar reports appeared: bactericidal protein-fractions derived from *Penicillium notatum* were described by Kocholaty[4] under the name of penatin and by Doisy *et al.*[5] under the name penicillin B.

Glucose oxidase, although not in its present role, has been known for some time. It is an enzyme found commonly in molds[6] and most abundantly in *Aspergillus niger*. It was recognized as a flavin enzyme.[7] Judging from the latest communications by Doisy *et al.*,[8] Kocholaty,[9] and by Birkinshaw and Raistrick,[3] there seems to be no reasonable doubt that the common mold glucose oxidase is the active principle in penatin and penicillin B as well as in notatin.

The conclusion reached by Raistrick *et al.* that their antibacterial activity was due essentially to the generation of hydrogen peroxide invited the rather obvious deduction that other oxidases may be found which act similarly. To prove this, it was decided to carry out appropriate experiments with xanthine oxidase. This H_2O_2 generating[10] enzyme was chosen because it may be easily obtained relatively free from counteracting factors, such as catalase, peroxidase, etc. Furthermore, the natural occurrence of this enzyme in milk suggested that with its appropriate substrate it may be employed as a milk preservative. It was, however, already known that in whole milk the hydrogen peroxide formed through xanthine or hypoxanthine oxidation would disappear almost as rapidly as it was formed.[11] Nevertheless, addition of hypoxanthine depresses, to some extent, bacterial growth in milk.

---

[1] Aided by a grant from the Commonwealth Fund.

[2] C. E. Coulthard, W. F. Short, R. Michaelis, G. Sykes, G. E. H. Skrimshire, A. F. B. Standfast, J. H. Birkinshaw and H. Raistrick, *Nature*, 150: 634, 1942.

[3] J. H. Birkinshaw and H. Raistrick, *Jour. Biol. Chem.*, 148: 459, 1943.

[4] W. Kocholaty, *Jour. Bact.*, 44: 142, 469, 1942.

[5] E. C. Roberts, C. K. Cain, R. D. Muir, F. J. Reithel, W. L. Gaby, J. H. Van Bruggen, D. M. Homan, P. A. Katzman, L. R. Jones and E. A. Doisy, *Jour. Biol. Chem.*, 147: 47, 1943.

[6] D. Muller, *Biochem. Zeits.*, 199: 136, 1928.

[7] W. Franke and M. Deffner, *Ann. Chem.*, 541: 117, 1939.

[8] J. T. Van Bruggen, F. J. Reithel, C. K. Cain, P. A. Katzman, E. A. Doisy, R. D. Muir, E. C. Roberts, W. L. Gaby, D. M. Homan and L. R. Jones, *Jour. Biol. Chem.*, 148: 365, 1943.

[9] W. Kocholaty, *Arch. Biochem.*, 2: 73, 1943.

[10] M. Dixon and S. Thurlow, *Biochem. Jour.*, 18: 971, 1924.

Enzyme preparation. It was desirable to use a preparation pure enough to allow hydrogen peroxide to accumulate sufficiently. Too highly purified preparations seemed undesirable because they tend to become unstable. A suitable degree of purity was obtained when we followed the isolation procedure of Corran *et al.*[12] up to their third step. Activity was measured manometrically in the manner described by Ball.[13] The enzyme solution we used for the preparation of our test solution was golden yellow in color; it contained 21 mg protein per ml and its Q_{O_2} was 120 (28° C.). To estimate roughly the amount of pure enzyme therein, the light absorption at 450 mμ, the maximum for riboflavin, was measured with the Beckman Spectrophotometer. About one third of the apparent flavin absorption may be attributed to enzyme-flavin (*cf.* [12]). We found $8.3\,\gamma$ flavin per ml attributable to xanthine oxidase. Using Ball's figure of 74,000[13] for the molecular weight per mole of flavin, it appears that in our preparation 1.7 out of 21 mg of protein per ml, or 8 per cent. was xanthine oxidase. The enzyme concentrations given in the following experiments refer to content of pure enzyme as estimated in the above manner.

Tests with this preparation showed a satisfactory stability of the enzyme and of enzymatically formed hydrogen peroxide. When three ml of a thirty times diluted solution of this enzyme preparation acted upon 5 micromols of hypoxanthine, the substrate was oxidized to completion in one hour, at which time 70 to 75 per cent. of the theoretically expected hydrogen peroxide was found in the solution.

TABLE 1

GROWTH OF STAPHYLOCOCCUS AUREUS IN BROTH CULTURE

Xanthine oxidase concentration	Additions	
	0	33 mg per cent. hypoxanthine
0	+	+
1 : 12,500	−	−
1 : 115,000	−	−
1 : 1,000,000	−	−
1 : 3,000,000	+	+

Inhibition of bacterial growth by xanthine oxidase. Small inocula of young cultures of a typical Staphylococcus aureus were used for the tests. Readings were taken after 18 hours incubation at 37° C. A sterilization of our enzyme was found unnecessary, the absence of bacteria being due probably to the effects of repeated freezing and thawing. This was fortunate because preliminary experiments showed an almost complete inactivation after filtering through a Seitz filter. The first experiments were done with broth as a culture medium. As shown in Table 1 no growth occurred with the enzyme concentrations down to $1:10^6$. Growth inhibition was, however, independent of addition to the broth of hypoxanthine, because the meat broth already contained, as we found afterwards, appreciable amounts of a substance oxidizable with xanthine oxidase. From the agreement between oxygen consumption and uric acid formation this was considered to be mainly or exclusively hypoxanthine.

In a second series (Table 2) a peptone medium was used, which showed no chemical reaction with the enzyme. With this medium xanthine oxidase alone was without inhibitory effect. Here inhibition was first brought about by incubation with enzyme together with its substrate, hypoxanthine. Tests for hydrogen peroxide with luminol[14] showed its presence in the inhibited samples and its absence in those where growth had occurred.

TABLE 2

GROWTH OF STAPHYLOCOCCUS AUREUS IN PEPTONE CULTURE

Xanthine oxidase concentration	Additions		
	0	hypoxanthine	
	growth	*growth*	H_2O_2
0	+	+	−
1 : 94,000	+	−	+ +
1 : 850,000	+	−	+
1 : 2,500,000	+	+	−

In the present case the enzyme concentration needed to effect inhibition is about one thousand times higher than that reported for glucose oxidase. We believe this to be due to a greater stability of the mold enzyme.

Experiments with milk. Relatively crude experiments were carried out. The effect of an addition of hypoxanthine to raw milk was evaluated after incubation at room temperature or in the refrigerator. Incubation at 37° resulted in too heavy growth even in the presence of hypoxanthine. Raw milk was infected lightly with *Staphylococcus aureus* and kept for one day at 23–25° C. The count for Staphylococcus was then 500,000 per ml with hypoxanthine against 2,500,000 without. Other organisms were similarly inhibited with the exception mainly of certain streptococci. In another experiment, without addition of extraneous bacteria, after one day in the refrigerator a count of 68,000 per ml was obtained with hypoxanthine against 133,000 without.

In a sense these experiments only confirm the fore-gone conclusion that hydrogen peroxide is inhibitory to certain bacteria, mostly anaerobic and facultative anaerobic types devoid of catalase.[15] Many of the pathogenic cocci are of this type. There may, in certain surgical cases, be merits to the slow but steady generation of hydrogen peroxide as brought about by an enzyme system. The difficulties of preparation, however, would outweigh any, probably rather limited usefulness.

---

[11] O. Schales, *Ber.*, 71: 447, 1938.

[12] H. S. Corran, J. G. Dewan, A. H. Gordon and D. E. Green, *Biochem. Jour.*, 33: 1694, 1939.

[13] E. G. Ball, *Jour. Biol. Chem.*, 128: 51, 1939.

[14] O. Schales, *Ber.*, 72: 167, 1939.

Fritz Lipmann
Cora R. Owen
Biochemical Research Laboratory,
and Surgical Research Laboratories,
Harvard Medical School, Massachusetts
General Hospital, Boston

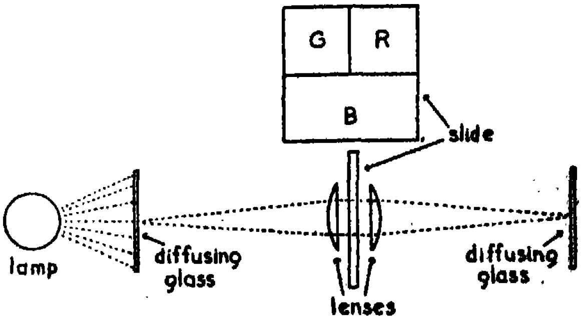
SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE THREE-COLOR MIXER USING FILTERED COLORS

The method of color mixing most commonly used in psychological laboratories is the rotating disc or color wheel. Though this method is excellent for many purposes, it has certain disadvantages inherent to the use of surface pigments: (1) mixtures are relatively low in saturation (particularly in the case of yellow produced by a mixture of red and green); (2) complementary mixtures are gray rather than white; (3) brightness can not be controlled independently of room illumination without sacrifice of saturation. These disadvantages can be avoided with mixtures produced with filtered colors.

A device which the author recently built uses an extremely simple principle to provide mixtures of three filtered colors. The general design would seem to be of potential value for such uses as (1) measurement of hue (and saturation) discrimination thresholds in both human beings and animals, (2) detection and analysis of color blindness, (3) specification of pigments in terms of three-color components by matching with three color mixtures, (4) classroom demonstrations of color mixing.

The optical system for accomplishing the trichromatic mixture is shown in Fig. 1. Gelatin color filters are mounted between glass, forming a square slide. One upper quadrant of the slide is red, the other quadrant is green, and the bottom half is blue. The filters used in the author's apparatus are Wratten gelatin filters of numbers 29 (red), 47 (green) and 61 (blue).



Optical System of Color Mixer

FIG. 1

This color mixing slide is supported on a two-way sliding mount between two lenses. Light from one diffusing screen is focused by the lenses upon another diffusing screen. Both screens are of flashed opal glass. Between the two lenses the light rays are parallel, and whatever colors intercept the light beam at this point become uniformly mixed on the second diffusing screen.

Two adjustments of the color-mixing slide are provided by means of levers moving along graduated scales. One lever moves the slide horizontally, thus changing the red-green proportion in the mixture. The other lever moves the slide vertically, thus adjusting the blue component. More specifically, by the two directions of movement, the slide can be adjusted to transmit any one of the three colors singly, or combinations of the three colors in any proportions. On the stimulus screen one can, therefore, obtain any color around or within the color circle. Due to the lack of homogeneity of the filtered colors, however, the resulting mixtures do not quite equal spectral mixtures in saturation. On the other hand, the mixtures far exceed in saturation those obtained on the color wheel.

That the color-mixing principle described here is successful was adequately demonstrated by a single unit built by the author while at the University of Missouri. Color mixtures of good saturation, moderately high brightness and uniform distribution were obtained.

The apparatus is particularly recommended for the demonstration of color-mixing principles. If intended for this purpose, the apparatus should be built so that the stimulus screen can be removed easily and the separate colors being mixed thus exposed to view.

Walter F. Grether
San Antonio Aviation Cadet Center,
San Antonio, Texas

BOOKS RECEIVED

Blackwood, Oswald. *General Physics.* Illustrated. Pp. viii + 622. John Wiley and Sons. $3.75.

Soper, Fred L. and D. Bruce Wilson. *Anopheles Gambiae in Brazil.* Illustrated. Pp. xviii + 262. The Rockefeller Foundation.

---

[15] J. W. MacLeod and J. Gordon, *Jour. Path. Bact.*, 25: 139, 1922.

SCIENCE

VOL. 98 FRIDAY, SEPTEMBER 17, 1943 No. 2542

Aristotle, Newton, Einstein: PROFESSOR E. T. WHITTAKER 249

Obituary:

Aleš Hrdlička: PROFESSOR WILTON MARION KROGMAN. *Recent Deaths* 254

Scientific Events:

Gifts and Grants to the University of Illinois; Field Museum of Natural History; The Third Nation-Wide Science Talent Search; New and Rare Instruments; Available Teachers of Collegiate Mathematics; The Woods Hole Marine Biological Laboratory 255

Scientific Notes and News 258

Discussion:

The Discovery and Development of Potash in Texas and New Mexico Permian: DR. A. F. WOODS. *"Chemical" Seed Treatments:* PROFESSOR K. STARR CHESTER. *Mineral Deposits:* DR. J. J. WOLFORD 260

Quotations:

The Retirement of Professor Raymond C. Archibald 261

Scientific Books:

The Blood in Tuberculosis: DR. E. M. MEDLAR 262

Special Articles:

An Experimental Test of the Framework Theory of Antigen-Antibody Precipitation: PROFESSOR LINUS PAULING, DR. DAVID PRESSMAN and PROFESSOR DAN H. CAMPBELL. *The Production of Multipolar Mitoses in Normal Embryonic Chick Cells:* DR. E. FRANCES STILWELL. *The Role of Night Temperature in Plant Performance:* PROFESSOR RAY H. ROBERTS 263

Scientific Apparatus and Laboratory Methods:

Microbiological Determination of Amino Acids: DR. K. A. KUIKEN, WILLIAM H. NORMAN, DR. CARL M. LYMAN and FRED HALE 266

Science News 12

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

ARISTOTLE, NEWTON, EINSTEIN[1]

By Professor E. T. WHITTAKER, F.R.S.

UNIVERSITY OF EDINBURGH

IT falls to us this year to commemorate the greatest of men of science, Isaac Newton, on the occasion of the three-hundredth anniversary of his birth. The centuries have not dimmed his fame, and the passage of time is unlikely ever to displace him from the supreme position. His discoveries, however—and this is part of their glory—have not persisted unchanged, but in the hands of his successors have been continually unfolding into fresh evolutions. During the eighteenth and nineteenth centuries there was an immense expansion of knowledge, springing directly from his work, and forming ultimately a vast superstructure based on the Newtonian concepts of space, mass, and force. Since 1900 the progress of science has continued, but the development of physics has changed in character: it has become subversive and radical, questioning the traditional assumptions and uprooting the old foundations. In 1915 the Newtonian doctrine of gravitation was superseded by that of Einstein: the divergence between the results of the two theories, so far as concerns the calculation of the movements of the planets, is extremely slight, and indeed, in almost all cases, too small to be detected by observation; but on the question of the essential nature of gravitation, the two conceptions differ completely and are associated with opposite philosophies of the external world. The other great discovery of the present century is the quantum theory, which in its perfected form of quantum-mechanics appeared in 1925: this also is completely irreconcilable with the postulates of Newtonian science.

We have therefore come now to the end of an age—

---

[1] Address of the president of the Royal Society of Edinburgh, October 26, 1942.

the age of classical physics—which we may count as having extended from the publication of Newton's "Principia" in 1687 to the acceptance of general relativity and quantum-mechanics by our own contemporaries—about 250 years. The replacement of the Newtonian fundamental assumptions by a wholly different set of concepts, which is now taking place, represents a change in the philosophical view of the world which future generations will regard probably as one of the major turning-points in the history of thought, and perhaps as the most significant event of our time.

This afternoon I propose to set the revolution of the twentieth century, by which the doctrines of classical physics have been overthrown, side by side with the revolution of the seventeenth century, by which they were originally established. It will appear that in some respects the second movement is reversing the direction of the first, and is bringing back ideas which were accepted in the great days of the Scholastic philosophy, but which, having been discarded at the Renaissance, have for the last three hundred years been unknown outside a small circle of scholars.

I have therefore taken for these remarks the title "Aristotle, Newton, Einstein." "Aristotle" stands for the interpretation of the world which was developed, on the foundation of the Aristotelian physics and metaphysics, by the Scholastic philosophers of the thirteenth century; "Newton" symbolizes classical physics, which displaced Scholasticism and is now in its turn outmoded; and "Einstein" represents the new conceptions which have arisen in connection with quantum-mechanics and general relativity and on which the physics of the future must be based.

Let us, then, first inquire what was gained and lost when the medieval philosophy was superseded in the seventeenth century by the doctrines of Descartes and Newton. To answer this question it is necessary to examine how the supersession came about. From the fourteenth century onwards, Scholasticism was decadent, and by the end of the sixteenth it had become thoroughly debased. The love of nature that had been so vital in Aristotle had almost perished; the practice of observation and experiment, on which he and St. Thomas had so strongly insisted, was neglected save by a few solitary workers; and the degenerate Schoolmen occupied themselves with futile subtleties that bore no relation to life and reality; they argued about homogeneities and heterogeneities, categorematics and syncategorematics, simpliciters and secundum quids; they resolved questions by the way of "formaliter," "materialiter," "fundamentaliter" and "eminenter"; and showed the causes of things in sympathy, antipathy and the influence of the heavens. No wonder that the virile scholars of the Renaissance broke away from it all. In Italy, under the patronage of the Medici, there was a revival of Platonism; and at Paris, in 1536, a crowded audience acclaimed the thesis of Peter Ramus, "Whatever is in Aristotle is false."

If philosophy and science were to be restored to life and health, the first necessity was, as Ramus saw, to re-establish contact with the external world. The chief pioneer in the movement back to nature, the great exemplar of the accurate quantitative observation of phenomena, was a friend of Ramus's, the Danish astronomer, Tycho Brahé, who lived from 1546 to 1601, and was thus about twenty years senior to Bacon and Galileo, and a century earlier than Newton. His observations, though made before the invention of the telescope and the micrometer, were astonishingly accurate; and some of his deductions from them were soon seen to be incompatible with the Aristotelian system of the world; thus, his memoir on a new star which appeared in the constellation Cassiopeia in 1572, by showing that this body was situated among the fixed stars, destroyed the belief in the eternal incorruptibility of the heavenly bodies; and his proof that the comet of 1577 moved around the sun in planetary space shattered the cosmology which located comets in the earth's atmosphere.

The work of Tycho firmly established the principle that natural philosophy must be based on quantitative data acquired from observation. But something more was needed in order to consummate the foundation of modern science, and this further element was contributed by his pupil Kepler. Kepler derived his conception from the revived Platonism which was then in favor; but actually it is traceable beyond Plato to his predecessors the Pythagoreans, and it may have been due to Pythagoras himself.

The original Pythagorean discovery related to the lengths of the strings of a lyre: it was found that if a string is stopped at half its length, it gives a note one octave higher; if at two thirds its length, it gives a note higher by the musical interval called a fifth, and so on. Thus simple numerical ratios were shown to exist between the lengths of strings which produce sounds harmonious to each other, and so a connection was set up between mathematics and esthetics. This was generalized into the principle that numerical laws, analogous to the numerical laws of harmony in music, were the proper means of interpreting the fundamental unity of the cosmos; that there must be a mathematical harmony of the external world underlying all phenomena; that this was the reality which philosophers sought, and that the task of men of science was to find it.

Moreover, it was asserted that the dispositions of nature were of the simplest character that could be imagined in any particular case. This consideration, which has in fact played a part of the first importance in the history of physics—in our own day it guided Einstein to the law of gravitation in curved space—was applied by Kepler in order to simplify the elaborate picture of the world which he had inherited from his predecessors. It is to be remembered that Copernicus, although he took the all-important step of placing the sun in the center of the universe, still retained the intricate machinery of epicycles which had been devised by Hipparchus to represent the motions of the planets, and which, by the successive adjunction of fresh curves to represent new discoveries, had by now become intolerably complicated: so much so that a royal patron of science, to whom it was described, remarked that "if the Deity had consulted him at the creation, he would have given Him good advice."

It seemed to Kepler that the truth must be much simpler than any one had yet realized; and that by use of the right kind of mathematics it should be possible to exhibit or suggest in some way a physical connection between the planets and the sun as the center of their motions. Eventually he succeeded in showing that the planes of the orbits of all the planets pass through the sun; that all the orbits are ellipses, having the sun as a focus; and that a line joining a planet to the sun sweeps out equal areas in equal times.

By the labors of Tycho and Kepler the modern procedure of science was instituted, and the true structure of the universe was revealed. At this point it may be observed that, while the Scholastic cosmology[2] was thereby completely disproved and overthrown, there was nothing in the new methods and discoveries that was inherently irreconcilable with the Scholastic metaphysics: the whole of Tycho's and Kepler's work might conceivably have been absorbed into the philosophy of the Schoolmen by a peaceful and conservative revolution. If this had happened, we in the twentieth century should have been spared the necessity of readjusting our position by a movement back towards Aristotelianism; but it was not to be. What did happen was a violent upheaval which swept away ontological doctrines equally with cosmological, destroying the old order entirely; an upheaval out of which the system of classical physics was formed, and which has dominated the relations of science, philosophy and religion with each other down to the present time.

The central figure of the movement on its metaphysical side was Descartes. As a young man he had become familiar with the degenerate Scholasticism of the day; but it had left him dissatisfied. Its conclusions were based principally on the affirmations of the great doctors; but the authority of the doctors was insecure, and the only branch of knowledge that seemed to be satisfactorily established was mathematics, whose procedure was to set out from self-evident postulates and to deduce from them results of practical value and incontrovertible truth. Descartes conceived the idea of searching for principles as certain as the axioms of mathematics, and on them as foundation to rebuild philosophy.

In pursuance of this design, he proposed far-reaching changes in the philosophy of nature. The first step—evidently suggested by the success of Kepler's work on the planetary orbits—was to describe the happenings of the external world in mathematical language. Now of all things presented to our observation, the spatial dimensions of bodies are the most obviously quantitative; he therefore seized on this feature, and based his system of the world on the affirmation that the characteristic of matter is extension. Another experience which is measurable is the passage of time; and hence the movement of bodies, which may be specified by the distance passed over in intervals of time, also admits of quantitative treatment. In terms of these two concepts matter and movement, Descartes proposed to explain the physical universe: quality was to be made intelligible as varying quantity.

In this scheme, extension constitutes matter, and matter constitutes space, which is therefore a plenum—there is no void. The sensations of sound, light, heat, taste and qualities generally are to be regarded as belonging to our consciousness, and purely subjective: in nature itself there is nothing but extension and the locomotion of its parts; the external world is a purely mechanical assemblage.

In the Cartesian transformation of philosophy the very meanings of the keywords were altered. Thus motion, which to the Scholastics had meant change of any kind, was now restricted to mean change of position; matter, which in the older doctrine was correlative to form, now meant simply corporeal being. Especially noteworthy is the new importance acquired by space and time. The Schoolmen had no word for "space" as we understand it; for spatium had rather the sense that "space" has in the Authorized Version of the Bible, *e.g.*, "All with one voice about the space of two hours cried out, 'Great is Diana of the Ephesians' "[3]; while locus meant the space occupied by a particular body. "Where" and "when," which to the Scholastics had been merely two among the ten predicaments of being, now came to dominate completely the description of nature.

That description was even more strictly mechanical than the Newtonian description which later superseded it, as may be seen, for instance, in their respective conceptions of gravitation. Gravity had been classified by the Schoolmen as an "occult quality"—that is to say, a force or tendency produced by no visible agency. Descartes denied the existence of occult qualities, and maintained, like the Greek atomists, that impact was the only mode in which one body could affect another: consequently he was compelled to furnish a new explanation of the fall of bodies towards the earth. This he did by postulating that surrounding the earth there is a vortex of subtle matter, or ether, which, by its pressure, provides the effect of gravity. Newton, on the other hand, formulated the inverse-square law without providing any mechanism to account for it; and in the preface to the second edition of the "Principia" there is a frank reversion to the Scholastic view of gravity as an occult quality.

---

[2] The word "cosmology" is here used in the sense that is customary in modern scientific writing, not the wider sense in which it is used in Scholastic philosophy.

[3] Acts xix, 34.

Thus in the picture of the world arrived at by Descartes, all the phenomena of astronomy and physics, so far as they were known at the time, were represented by aggregations or motions or pressures in the plenum of space. Nothing resisted his mechanical explanations, except the thought of man; this could not be brought into any relation with extension, and was evidently not amenable to mathematical analysis. It must, therefore, he concluded, have a principle other than matter; and thus he arrived at a dualistic philosophy, and divided reality into the two great classes of extended and thinking substances, *res extensa* and *res cogitans,* the objective and the subjective, the corporeal and the spiritual world. As matter is characterized by extension, so the mind is characterized by thought: the two are completely independent, and no explanation of any relation between them is forthcoming.

The complete disjunction of the psychical from the physical, which was characteristic of Cartesianism, has profoundly affected the subsequent history of science, and indeed of almost every department of human thought. In the first generation after Descartes there was an uneasy recognition of the possibility that—since any view of the cosmos must have a theological bearing—the new natural philosophy might prove harmful to religion; and in fact a keen controversy broke out on this very question. The dispute was centered round the doctrines of space and time, which in this period underwent a profound change.

The principal agent of the change was Pierre Gassendi (1592–1655), who, opposing Descartes' representation of space as a plenum, revived the doctrines of the ancient atomists regarding the void. This implied making a distinction between matter and extension, and asserting that while space has extension, matter has solidity as well, and occupies only a part of space. Gassendi's ideas were adopted by Newton, and thus was evolved the portrayal of space and time which became finally established in classical physics. Its fundamental postulate is that all the phenomena of the external world can be described in terms of the location and motion in space of entities, each of which has some degree of persistence and continuous identity in time. Thus whatever happens, happens in space—space, the stage on which the drama of physics is to be played, is the dominating conception of the whole system. This had not been at all the point of view of Scholasticism, and, as we shall see later, the recent progress of physical discovery has shown that it is radically unsound.

By Newton, space is regarded as having a positive, objective existence, which is not attached in any way to subjective necessities of the human mind. "Absolute space," he says, "in its own nature, without regard to anything external, remains always similar and immovable"[4] and "all things are placed in space as regards order of situation."[5] It is a real entity, subsisting prior to, and independently of, the bodies which it contains; and all events in nature can be represented by movements within it. Every point of space persists throughout an infinite succession of instants of time, and the notion of simultaneity is valid, with all the implications which it carries in classical physics. In the Gassendi-Newton scheme it is not considered necessary to account for the existence of entities which are permanent over appreciable durations of time, such as (in the earlier period) particles of matter: these are postulated, and the aim of science is to explain the changing phenomena of the universe in terms of their motions. Persistence of bodies in time and their displacement in space are the concepts to which everything in the external world is to be reduced.

The attempt to fit this doctrine into the framework of philosophy and theology was confronted by the difficulty that besets all systems based on the Cartesian bifurcation between mind and matter, namely, that no provision is made for the interaction of spiritual with corporeal being. A possible solution seemed to be indicated by an idea put forward in 1647 by the Cambridge Platonist Henry More, that in some part of the human brain there is a *sensorium* or organ of internal sensation where the understanding resides, to which the images of external things are conveyed by the organs of sense, and where they have a "tactual conjunction" with the soul, which thus perceives them. Newton now boldly suggested that space might be the Sensorium of God. "Does it not appear from phenomena," he said,[6] "that there is a Being incorporeal, living, intelligent, omnipresent, who in infinite space, as it were in his sensory, sees the things themselves intimately, and thoroughly perceives them, and comprehends them wholly by their immediate presence to himself?"[6]

---

[4] "Spatium absolutum, naturâ suâ sine relatione ad externum quodvis, semper manet similare et immobile," "Principia," *Schol. ad. Defin.*

[5] "In spatio quoad ordinem situs locantur universa," *ibid.*

The idea that God had to be fitted into a scheme of which matter, space and time were the primary concepts was attacked by Leibnitz, who rejected altogether the doctrine of an absolute space and time having reality outside our minds, and maintained that space is only a conceptual entity, an order according to which situations are disposed, and time is only an order of succession. His argument against Newton may be put in a modern form somewhat as follows: During the operation of "summer time" the clock is an hour ahead of Greenwich time. This fact is, however, not made evident by any of the ordinary happenings of life, since all clocks, departures of railway trains, office hours, mealtimes and so forth, bear to each other the same relations as before: in order to detect the change we have to observe something which does not obey the Act of Parliament establishing summer time, such as the moment of sunset. Now suppose that some way could be found of compelling the heavenly bodies to adapt themselves to summer time on the same day as our clocks: then, after this, it would be impossible by any observations whatever to tell which kind of time we were keeping: the only evidence would be that furnished by memory—the recollection of the day which had only 23 hours, when the clocks were put forward. Let us now imagine that day to recede into the past, back to the creation of the world. Would there then be any difference between the two systems? Or to put the same question in another form, is there any meaning in the statement that God might have created everything an hour sooner? Newton would say, Yes. Leibnitz would say, No. I leave the fellows of the society to form their own judgment on the matter.

Another count in Leibnitz's indictment of Newtonianism related to the concept of force, the *vis motrix* of the "Principia," which in the case of gravity was represented as acting at a distance. "Some men," wrote Leibnitz, "begin to revive, under the specious name of 'forces,' the occult qualities of Scholasticism; but they bring us back again into the Kingdom of Darkness."[7] Now "force" in its statical sense, as, for instance, when we speak of "the force exerted by the weight of one pound," was a familiar idea to the Schoolmen: their physics included what they called *scientia de ponderibus*, which dealt with such matters as the law of equilibrium of the lever and the apparent weight of a body resting on an inclined plane. But the kinetic relations of force were unknown in the Middle Ages, and were first formulated in the "Principia," in the Second Law of Motion, which equates force to the product of mass and acceleration.

Newton showed how the known connection between forces and accelerations made it possible to write down equations, by which the motion could be determined. But before long it was found that, at any rate when the system studied was only a single particle, the motion could be calculated without bringing in forces or accelerations, by making use of what would now be called the principle of conservation of energy. When a pendulum is drawn to one side, so that the bob is higher than when it is hanging vertically, it has energy in the potential form (in this case due to gravitation); when the pendulum is released, it begins to swing, the potential energy being changed into energy of motion. This way of regarding dynamics shows a certain affinity with the Scholastic philosophy; for the physics which the Schoolmen appropriated from Aristotle was dominated by the idea that there are two ways of Being, potency[8] and act,[9] and that all change is a transition between a state which is potential and a state which is actual.

For a problem in classical mechanics there is of course no contradiction between the solution which is obtained by using the concept of potential energy and the solution by the original Newtonian method which uses the concept of force: the two are mathematically equivalent. But in the present century it has been found that the mutual influence between elementary particles is governed not by the laws of classical mechanics but by those of quantum mechanics, in which the concept of force is abolished and the interaction is represented by a term corresponding to the potential energy of classical mechanics, but of a more abstract character; it is called an operator, and, like potential energy, may be attached to the Aristotelian concept of potency.

To return to classical physics, a further change in its outlook was brought about by the discovery of what are called minimum-principles. A simple example is afforded by the hanging chain. Suppose that a chain is suspended between two points of support: what will be the curve in which it will dispose itself? We all know the general appearance of the curve: it is something like an arc of a circle joining the two points of suspension. Actually it is not part of a circle, but a curve known as a catenary: this was discovered towards the end of the seventeenth century by the Newtonian method of considering the forces which act between consecutive links of the chain. The problem may, however, be solved in a quite different way, without introducing the idea of force, by assuming that the chain arranges itself in such a way as to make its center of gravity have the lowest possible position. This assumption, that the height of the center of gravity is a minimum, is a typical minimum-principle. At least one minimum-principle was known to the ancient Greeks, namely, that when a ray of light issuing from a source is reflected at a mirror and afterwards received by an observer, then the path followed by the incident and reflected rays is shorter than any other path from the source to the observer which meets the mirror.

---

[6] *Opticks*, Qu. 28.

[7] "A Collection of Papers which passed between Mr. Leibnitz and Dr. Clarke" (London, 1717), p. 265.

[8] δύναμις, *potentia.*

[9] ἐνέργεια or ἐντελέχεια, *actus.*

By a succession of discoveries it was shown that all the happenings of nature can be predicted by means of minimum-principles: the climax was reached in 1915, when Hilbert showed that all physical events (gravitational, electrical, etc.) in the universe are determined by a "world-function" which is such that its integral taken over the whole of space-time is a minimum. Such a statement as this has a decidedly Aristotelian character; for, in studying change, Aristotle always fixed his attention on the end to be fulfilled: his science was essentially teleological. Again we see how classical physics, following its own natural development, tended to deviate from the pattern devised by Newton and to return to the Aristotelian-Scholastic mould.

A change in orientation such as this, however, did not affect the fundamental assumptions of Newtonian science. We have now to consider developments of a far more subversive nature.

The first serious trouble arose in connection with the doctrine of space. The space of Gassendi and Newton was, so far as geometry was concerned, the space of Euclid: it was infinite, homogeneous and completely featureless, one point being just like another; so far as physics was concerned, it was like the vacuum of the ancient atomists, mere emptiness into which things could be put. From the philosophical point of view this concept was open to the objection that Aristotle had urged against the doctrine of the atomists, namely, that if space were devoid of local properties, the tendency of a body to move spontaneously in a particular direction (*e.g.*, the existence of a gravitational field, as we should say) would be unintelligible. As a matter of fact, the successors of Newton felt this difficulty; and, having started with a space which was in itself simply nonentity, having no property except a capacity for being occupied, they proceeded to fill it several times over with ethers designed to provide electric, magnetic and gravitational forces, and to account for the propagation of light; and as it was impossible to draw any effective distinction between those ethers and space, Newtonian space became eventually a plenum of the most elaborate kind, possessing such qualities as density and rigidity everywhere. Its points were capable of individual identification, and could be regarded as fixed; and having thus acquired a more definite and concrete substantiality than Newton himself had ever contemplated, its absolute character became an essential and inseparable axiom of classical physics. But the discovery in 1905 of the principle of relativity led to inferences incompatible with the existence of any kind of quasi-material ether: and thus the Gassendi-Newton doctrine became involved in hopeless contradiction.

(*To be concluded*)

OBITUARY

ALEŜ HRDLIĈKA

March 29, 1869–September 5, 1943

ALEŠ HRDLIČKA was born of worthy middle-class parents at Humpolec, Bohemia. In 1882 the family moved to New York. There, in 1892, he got a degree at the Eclectic Medical College of the City of New York and in 1894 from the New York Homeopathic Medical College. Soon after he joined the staff of the State Homeopathic Hospital for the Insane at Middletown, N. Y., and also became affiliated with the Pathological Institute of the N. Y. State Hospitals. His early years with the mentally and physically abnormal convinced him of the need for knowing the normal, and this became the guiding principle of his entire scientific life.

Dr. Hrdlička was truly a prodigious worker, both in the laboratory and in the field. In 1898 he took his first field trip, with Lumholtz to Mexico, where he studied the Tarahumares, the Huichols and the Tepehuanes. These trips were continued in 1899–1902, to the southwestern United States and northern Mexico, under the auspices of the Hyde expeditions of the American Museum. He had an unusual ability to "get along" with natives, and these field trips were very fruitful. They were the first of many that took him all over the world: to Egypt and the Near East in 1909, to Siberia and Mongolia in 1912, to Peru in 1913, to the Far East in 1920, to Africa, Asia and Oceania in 1925, to Alaska and the Aleutians in 1926–38, to Russia and Siberia in 1939, besides numerous trips to Europe and expeditions within the United States.

In 1903 Dr. Hrdlička became assistant curator and in 1910 curator of the Division of Physical Anthropology of the U. S. National Museum, a position which he held until his retirement in 1941. In this capacity he published countless articles and many books. Among the latter are: "Skeletal Remains Suggesting or Attributed to Early Man in North America" (1907, 1918); "Physiological and Medical Observations among the Indians of Southwestern United States and Northern Mexico" (1908); "Early Man in South America" (1912); "The Most Ancient Skeletal Remains of Man" (1914, 1930); "Anthropometry" (1920); "The Old Americans" (1925); "Anthropological Survey of Alaska" (1930); "Children Who Run on All Fours" (1931); "Practical Anthropometry" (1939); "Alaska Diary" (1943); "Catalogues of Human Crania in the U. S. National Museum" (1924, 1925, 1927, 1928, 1931, 1942).

In 1896 Dr. Hrdlička married Marie Dieudonnec, of New York City. Her death in 1918 was greatly mourned. In her honor there was established the "Aleš and Marie Hrdlička Foundation" in Czechoslovakia, which subsidized, in part at least, a chair of anthropology at the Charles University in Prague and the Czech journal *Anthropologie,* in publication since 1923.

Dr. Hrdlička's greatest contributions were in founding the *American Journal of Physical Anthropology,* of which he was editor from 1918–1942, and in establishing in 1929 the American Association of Physical Anthropologists, of which he was president from 1929 to 1932. To the journal he gave unstintedly of time, energy and devotion; in its formative years he was its financial "angel." To the association he gave years of wisdom and a rare, sympathetic insight into human nature. He was jealous of the reputation of the "science of anthropometry," feeling that "it will be practiced as long as man is interested in the study of his kind." In protecting this reputation he at times leaned over backward to guard against what to him seemed impractical innovations or extravagant or unwarranted claims and deductions.

Many honors came to Dr. Hrdlička: the chairmanship of the Anthropological Society of Washington (1907), Section H of the A.A.A.S. (1918), of the American Anthropological Association (1925–1926) and of the Washington Academy of Sciences (1929). He had an honorary Sc.D. from Prague (1922) and Brno (1926). He was a member of the National Academy of Sciences and of the American Philosophical Society.

In the Epilogue to "Alaska Diary" Dr. Hrdlička speaks of the volume as the views of "a medical man, an anthropological explorer, and a human human . . . a story of sustained, systematic assiduous search for evidence that might aid in clearing the aboriginal history of (Alaska)." This says what we all feel toward his memory: he was a great scientist, but first he was a warm-hearted, unselfish, lovable human being.

WILTON MARION KROGMAN
UNIVERSITY OF CHICAGO

RECENT DEATHS

DR. FREDERICK PAUL KEPPEL, dean of Columbia College from 1910 to 1918 and from 1923 to 1941 president of the Carnegie Corporation, died on September 8. Since his retirement he had served with the State Department in Washington as a member of the Board of Appeals on Alien Cases.

Nature reports the death of T. J. Jehu, emeritus regius professor of geology of the University of Edinburgh, and at the age of fifty-eight years of Sir Stopford Brunton, Bt., the Canadian mining geologist.

SCIENTIFIC EVENTS

GIFTS AND GRANTS TO THE UNIVERSITY OF ILLINOIS

TWENTY-NINE gifts and grants to the University of Illinois amounting to more than $127,000 were reported at the last meeting of the Board of Trustees. They are for research, for scholarships and for special items such as books.

The largest of the grants was $75,000 from the Upjohn Company, Kalamazoo, Mich., for a three-year study of the synthesis of penicillin which will be conducted by the department of chemistry, and in addition the company has provided $1,200 for a postdoctorate research assistantship in chemistry.

The sum of $1,200 was received from the Nutrition Foundation, Inc., New York, in support of research into the amino-acid requirements of man and of $2,400 to support research on calcium utilization by man. Grants were made by the William S. Merrell Company of $7,500 for fellowship stipends to support research in chemistry; by the John and Mary R. Markle Foundation, New York, $7,000 in support of research on high blood pressure; by the Allied Chemical and Dye Corporation, two fellowships in organic chemistry of $750 each; by Sharpe and Dohme, Philadelphia, $1,500 for study of certain animal diseases; by Cerophyl Laboratories, Kansas City, $1,200 for research in botany; by the Monsanto Chemical Company, St. Louis, $4,500 for a research fellowship on insecticides; by the Eastman Kodak Company, $1,000 for a fellowship in chemistry.

A gift of $500 was made by the W. K. Kellogg Foundation, Battle Creek, Mich., to the College of

Dentistry for student aid; The Farm Foundation, Chicago, gave $425 toward work of the Land Tenure Committee of the North Central States; the Illinois Congress of Parents and Teachers gave $400 for annual scholarships, and Mrs. Kittie B. Pierce gave $300 for the Phyllis Pierce Ruettinger scholarship fund.

FIELD MUSEUM OF NATURAL HISTORY

FIELD MUSEUM OF NATURAL HISTORY will be fifty years old on September 16. The following is an official summary of events of importance in the history of the museum.

A charter was obtained on September 16, 1893, under the title, Columbian Museum of Chicago. The name was changed in 1894 to Field Columbian Museum, and it was again changed in 1905 to the present form, Field Museum of Natural History.

Much of the sum originally subscribed in cash—$1,443,408—necessarily had to be expended during the early years to purchase collections, exhibition cases and equipment, and to defray organizing and administrative expense.

Under the will of Marshall Field, whose death occurred on January 16, 1906, $8,000,000 was bequeathed to the museum with the stipulation that $4,000,000 was to be added to the endowment fund and $4,000,000 was to be used for the construction of a new building. This bequest of Mr. Field's brought the total amount of his gifts to $9,430,000.

For three years prior to the completion of the present building, the efforts of the entire staff were devoted to packing the collections and preparing them for transfer from the original building in Jackson Park. Actual moving started on April 26, 1920. A railroad spur was built through Jackson Park to the old building, and another was built to the new building, and all the collections, exhibition cases and equipment were moved by the use of freight cars and trucks. By May 2, 1921, the new museum building was opened.

Since the founding of the museum, 440 expeditions have gone out to all parts of the world, and this number does not include many hundreds of small trips classified as local field work.

The collections shown in exhibition cases are but a small part of the total. In research, the study collections of museums are of the greatest importance. They are used by scientific men from all over the world and are the basis of much of our present-day knowledge. Those at Field Museum rank high both in extent and in usefulness.

During the fifty years under review, the museum has printed 566 scientific publications, most of them the results of its own expeditions and research. It has also published eighty-eight leaflets written in popular style.

Field Museum Library contains approximately 130,000 books and pamphlets on anthropology, botany, geology, zoology and related subjects, and offers the largest reference collection in its special fields in Chicago.

It is interesting to note that during the museum's occupancy of the old building in Jackson Park, from June 2, 1894, to February 23, 1920, a period of approximately twenty-six years, the attendance was 5,839,579, whereas the attendance in the present building from May 2, 1921, to June 16, 1943, approximately twenty-two years, has been 27,576,728.

The museum has realized the importance of exhibiting all types of material in a way that would attract and educate the layman visitor. It was among the first to install animal habitat groups in natural settings.

THE THIRD NATION-WIDE SCIENCE TALENT SEARCH

THE third annual Science Talent Search, for promising scientific ability among high-school graduating seniors, will be conducted during the fall and winter months of the school year.

Open alike to boys and girls, the search will enlist the aid of high-school principals and teachers who will administer tests and supply other necessary data. Westinghouse Science Scholarships amounting to the sum of $11,000 will be awarded to at least ten, and possibly forty, of the successful contestants. In addition, all forty will attend a five-day Science Talent Institute on an all-expense trip to Washington next February.

In the second Talent Search, completed last spring, some fifteen thousand seniors requested examinations, three thousand, four hundred completed the requirements and two hundred and sixty were awarded honorable mention. Of the forty taken to Washington, eleven were girls and twenty-nine boys.

Watson Davis, director of Science Service, said that students in public, private and parochial schools desiring to enter the Science Talent Search this fall will take a special aptitude examination under supervision of school officials in their home communities between December 3 and 27. The forty who pass the examination, and qualify on the basis of personal and scholarship records and essays, will be named delegates to the institute.

Final examinations during sessions of the institute will determine the award of two four-year Westinghouse Science Grand Scholarships of $2,400 each and eight four-year Westinghouse Science Scholarships of $400 each. One boy and one girl will be selected to receive the Grand Scholarships. The Westinghouse Electric and Manufacturing Company provides the scholarship awards as a contribution to the advancement of science in America. Additional Westinghouse scholarships amounting to $3,000 will be awarded at the discretion of the judges. If any scholarship recipient should be drafted or enter other government war service, his scholarship will be held for his use later.

NEW AND RARE INSTRUMENTS

URGENT requests for instruments difficult or impossible to obtain through customary channels continue to reach the Committee on Location of New and Rare Instruments. Many of these can be filled and vital research projects greatly helped. Particularly needed are sensitive electrical instruments (milli- and micro-volt and ammeters) and usable optical instruments or parts.

Requests in the hands of the committee that remain unfilled are:

Pressure autoclaves
Metallurgical microscopes
Polarizer and Analyzer for microscopes
Abbe refractometers (16 requests)
Strobotacs
L. & N. Portable Thermocouples
Cenco Impulse Counters

Instruments available through the committee include:

Various balances
S. & H. Colorimeters
L. & H. H ion meter
Microtomes
pH apparatus
Polarimeters
Potentiometers
Pyrometers
Hilger-Spekker Spectrophotometer
Viscosimeters

Instruments are requested for both loan and outright purchase. Those who have instruments that they can spare should send a list of them to D. H. Killeffer, *chairman*, 60 East 42d St., New York 17, N. Y.

AVAILABLE TEACHERS OF COLLEGIATE MATHEMATICS

THE Committee on Available Teachers of Collegiate Mathematics, established by the War Policy Committee of the American Mathematical Society and the Mathematical Association of America, has been in existence since the beginning of April, 1943. During this time it has received and answered numerous inquiries from colleges and universities needing teachers of mathematics, as well as from teachers who were free to accept appointments.

It is anticipated that the demand for teachers will increase considerably during the next two or three months. On the other hand, the number of available well-qualified candidates who have registered with the committee for such appointments has been reduced to such an extent that the remaining supply has become quite inadequate to meet the expected demand.

For this reason, the committee requests departments of mathematics to inform them at the earliest possible date (a) of their needs during the next half year, giving as full details as they can concerning the qualifications expected, the salary offered and other pertinent facts relating to their vacancies; (b) of members who are free to fill temporary positions in other institutions.

The committee would also appreciate hearing from individual teachers.

Committee on Available Teachers,
W. D. CAIRNS
ARNOLD DRESDEN
J. R. KLINE

110 BENNETT HALL,
UNIVERSITY OF PENNSYLVANIA

THE WOODS HOLE MARINE BIOLOGICAL LABORATORY

RESEARCH and teaching at the Marine Biological Laboratory at Woods Hole, Mass., has continued as usual during the summer although, owing to wartime conditions, on a reduced scale, according to an article by Dr. Charles Packard, director, in a forthcoming issue of *The Collecting Net.* Approximately half the normal number of investigators and students attended the sessions this season.

The United States Navy continues to occupy the mess hall of the laboratory, the old lecture hall and the botany building as well as the apartment house and one of the older residential buildings. The laboratory has taken over an inn several blocks from the main building which it operates effectively.

Friday evening lectures were given as usual this season. The speakers were Drs. W. R. Taylor, D. P. Costello, P. S. Galtsoff, R. T. Kempton, L. V. Heilbrunn, Kurt G. Stern, B. M. Duggar and A. H. Woodcock. The regular weekly seminars were discontinued. For the first time for over fifty years the course in botany was omitted because of insufficient registration.

The financial condition of the laboratory is satisfactory, and funds are available to meet current expenses. However, this is being done partly with money previously used in paying for subscriptions to foreign journals.

At the meeting of the corporation in August Professors W. E. Garrey and B. M. Duggar were made trustees emeriti, and in their places Dr. P. S. Galtsoff, senior biologist in the U. S. Fish and Wildlife Service, and Dr. E. W. Sinnott, professor of botany at Barnard College, Columbia University, were elected to complete their four-year terms. Dr. Otto Glaser, professor of biology at Amherst College, was reelected clerk of the corporation. Memorials were read for Gary Nathan Calkins and Hermon Carey Bumpus, who died during the year, both of whom had been members of the corporation for nearly fifty years. An expression of appreciation for Dr. Lillie's long and valuable services was read. Dr. Lillie retired from the presidency of the corporation in 1942 after more than forty years of service as administrator of laboratory affairs.

At the meeting of the trustees seven new members were elected to the corporation. It was the sense of the meeting that the attendance at the laboratory after the war would not only equal that of 1940 (when 386 investigators and their assistants represented 148 institutions) but that it would greatly exceed it. In anticipation of this expansion a committee on additional funds, consisting of Drs. D. E. S. Brown, *chairman,* F. R. Lillie, E. G. Conklin, E. N. Harvey, G. H. A. Clowes (with Laurence Riggs, Dr. C. Packard and D. M. Brodie as *ex-officio* members), has formulated plans for setting up teaching fellowships and scholarships for biologists who would work in Woods Hole throughout the year; for securing funds for a new building to replace the old main building and the other wooden laboratories, and for additional endowment.

SCIENTIFIC NOTES AND NEWS

The Julius Friedenwald Medal of the American Gastroenterological Association has been awarded to Dr. Thomas R. Brown, associate professor of medicine emeritus of the School of Medicine of the Johns Hopkins University. The July issue of *Gastroenterology* was dedicated to Dr. Brown "in recognition of his many accomplishments as a clinician and a teacher and to mark his contributions in the field of gastroenterology."

It is reported in *The Times,* London, that the joint advisory committee of the Wellcome Foundation and the Veterinary Educational Trust has awarded the first Wellcome Junior Fellowship for Veterinary Research to John Lochiel McGirr.

Dr. Fremont A. Chandler, associate professor of orthopedic surgery at the Medical School of Northwestern University, has become professor of orthopedic surgery and head of the department at the College of Medicine of the University of Illinois, Chicago.

Dr. Richard J. Winzler, research fellow of the National Cancer Institute, has been appointed assistant professor of biochemistry at the Medical School of the University of Southern California, Los Angeles.

Dr. Saul Gerald Cohen, of the Converse Memorial Laboratory of Harvard University, has been appointed a national research fellow to work under Dr. William G. Young, chairman of the department of chemistry of the University of California at Los Angeles.

Dr. Elizabeth Bindloss Johnson has been appointed to an assistant professorship in botany at Connecticut College, and Dr. Betty F. Thomson to an instructorship. The former returns to Connecticut after two years at Wellesley College; the latter has held a similar teaching position at the University of Vermont.

H. C. Shetrone, director of the State Archeological and Historical Society of Columbus, Ohio, was elected at the recent annual meeting president of the Ohio Academy of Science.

Officers of the newly organized Society for Research in Psychosomatic Problems are Dr. Winfred Overholser, Washington, D. C., *president-elect;* Dr. Tracy J. Putnam, New York, *president,* and Dr. Edwin G. Zabriskie, New York, *secretary-treasurer.* Dr. Adolf Meyer, professor of psychiatry emeritus, of the School of Medicine of the Johns Hopkins University, was elected honorary president.

Dr. Robert P. Fischelis, secretary and chief chemist of the Board of Pharmacy of the State of New Jersey, has been reappointed for a term of four years a member for pharmacy of the New Jersey State Board of Health.

At the recent annual meeting of the British Genetical Society the following officers were elected: *President,* Dr. C. D. Darlington; *Vice-presidents,* Dr. R. N. Salaman, Professor T. J. Jenkin, Professor R. A. Fisher; *Treasurer,* Miss E. R. Saunders; *Secretaries,* E. B. Ford, University Museum, Oxford; W. J. C. Lawrence, John Innes Horticultural Institution.

Dr. Carleton R. Ball, principal agriculturist and executive secretary of the correlating committee of the U. S. Department of Agriculture, the Tennessee Valley Authority and the Valley-States Land-Grant Colleges, retired on June 30. Appointed a collaborator, he has an office with the Extension Service of the department. Uncompleted projects now under way include "Federal, State and Local Administrative Relations in Natural Resources," a monograph of the willows, a volume on agricultural history in America and one on how to write technical manuscripts.

Dr. Harry S. Ganders, dean of the School of Education of Syracuse University, has been appointed acting dean of the Graduate School. He succeeds Dr. William L. Bray, who retired on September 1.

Bradley Dewey, president of the Dewey and Almy Chemical Company, deputy rubber director to William M. Jeffers, who resigned on September 4, has been appointed to succeed Mr. Jeffers, with the title of acting rubber director.

Dr. M. R. Benedict, professor of agricultural economics at the University of California at Berkeley and agricultural economist of the Giannini Foundation, is now in Washington, D. C., where he will act as consultant on food for the Office of Lend-Lease Administration. Professor Benedict will return to the College of Agriculture on February 29, the beginning of the spring term.

Robert R. West, president of the Esmond Mills, has been appointed chairman of the committee on economic research of the Textile Research Institute. The principal function of the committee is to recommend to the institute important projects in economic research and to supervise their production.

Dr. Florence Clyde Chandler, technical research assistant to Dr. A. B. Stout, has resigned from the scientific staff of the New York Botanical Garden in order to participate in a project of breeding cinchona for high yields of the alkaloids which include quinine.

The Committee of the British Privy Council for Agricultural Research has appointed Lord De La Warr to be chairman of the Agricultural Research Council in succession to the late Sir Thomas Middleton. The committee has also appointed Professor I. de Burgh Daly, F.R.S., to be a member of the Agricultural Research Council in the place of Sir Joseph Barcroft, F.R.S., whose term of office as a member has expired.

Dr. George B. Cressey, chairman of the department of geography and geology of the University of Syracuse, has leave of absence to accept an appointment as representative of the United States Department of State in China. The appointment is in connection with Cultural Relations in China of the department. Dr. Cressey will work at the Chinese universities.

Early in July, Dr. Frank H. H. Roberts, Jr., of the Smithsonian Institution, spent five days in the Abilene, Texas, region with Dr. Cyrus N. Ray examining a stratified river bank burial situated twenty-one feet below the soil surface and eight other deeply buried widely separated stream bank midden sites located on three different water courses of the region. Among those visited were the McLean and Gibson sites and the sites in the Matthews and Putnam ranches.

Mrs. Grace Needham Oliver, assistant in mineral economy in the Illinois State Geological Survey and editor for several years past of the *Transactions* of the Illinois State Academy of Science, has moved to Washington, where her husband, Dr. Revilo P. Oliver, is engaged in war service. Miss Dorothy E. Rose, technical editor for the Illinois State Geological Survey, will serve in Mrs. Oliver's place as editor for the Illinois Academy.

The fourth conference on Science, Philosophy and Religion in their Relation to the Democratic Way of Life opened at Columbia University on September 10. All the papers presented dealt with some aspect of the problem of abolishing war. The chairmen of the various sessions were Dr. Charles W. Hendel, professor of moral philosophy, and Dr. Mark A. May, director of the Institute of Human Relations, Yale University; Dr. Harlow Shapley, director of the Harvard Observatory; Dr. Harry A. Overstreet, professor emeritus of philosophy, College of the City of New York; Dr. Lyman Bryson, professor of education, Teachers College, Columbia University; the Reverend Hunter Guthrie, Georgetown University; Dr. Robert M. MacIver, professor of sociology, Columbia University, and the Reverend Gerald P. Phelan, the Pontifical Institute of Mediaeval Studies, Toronto, Canada.

At the twenty-fifth annual National Metal Congress in Chicago during the week of October 18 presentation will be made of two newly established medals. These are the Gold Medal and the Medal for the Advancement of Research of the American Society for Metals, which will be awarded during the annual dinner at the Palmer House on October 21. The Gold Medal will be awarded to one recognized for outstanding metallurgical knowledge who has shown great versatility in the application of science to the metal industry. He will have exhibited exceptional ability in the diagnosis and solution of diversified metallurgical problems relating to different fields of metallurgy of one metal or individual fields applied to several metals. This award will comprise a gold medal, certificate and citation, and will be given only as often as a candidate of exceptional merit can be recognized. The recipient of the Research Medal will be an executive in an industrial organization the principal activity of which is the production or the fabrication of metals. He will be one who, over a period of years, has consistently sponsored metallurgical research or development and by his foresight and his influence in making available financial support has helped substantially to advance the arts and sciences relating to metals. This award will consist of a medal, plaque and citation.

The fourth meeting of the Anglo-American Caribbean Commission, under the United States co-chairman, Charles W. Taussig, opened on August 17 at Charlotte Amalie, St. Thomas, Virgin Islands. According to *The Times*, London, the British representatives included the British co-chairman, Sir Frank Stockdale, and A. J. Wakefield, inspector-general of agriculture in the West Indies, who has been nominated a British member for the meeting. There was established a Caribbean Research Council which will serve in an advisory capacity for scientific, social and economic research for the benefit of the people of the area. The main subject of the agenda was agricultural research. The commission therefore invited representatives from the agricultural experimental stations of the United States, Great Britain and the Netherlands in the Caribbean area to attend. It adopted as the basis of the discussions the recommendations and report of the United Nations Food Conference at Hot Springs with the object of providing for coordinated effort in the planning of agricultural and other research in the Caribbean by the research institutes and experimental stations represented. These recommendations will also assist the commission in its study of nutritional, agricultural and fisheries problems.

ACCORDING to *The Experiment Station Record*, largely because of the establishment of other organizations now carrying forward its avowed objects decision has been reached to dissolve the Tropical Plant Research Foundation. Its assets are to be divided, the Inter-American Institute of Agricultural Sciences of Turrialba, Costa Rica, receiving the Tropical Agricultural Library and the Boyce Thompson Institute the office equipment. The residual cash and bonds, expected to net about $4,500, are to be given to the Division of Biology and Agriculture of the National Research Council for use in the promotion of tropical agriculture.

THE Tufts College Medical School, Boston, will celebrate its fiftieth anniversary from September 15 to October 6. According to the *Journal* of the American Medical Association, the program includes an address at the medical school, on September 15, by Major General James C. Magee on "Military Medicine with Special Reference to Tropical Diseases"; a lecture before the William Harvey Society on September 16 at the Beth Israel Hospital by Dr. Timothy Leary, professor emeritus of pathology at the school, on "Excess Cholesterol as a Pathogenic Agent," and a talk on September 29 by Colonel Raymond W. Bliss. On September 22 a feature of the celebration will be the presentation and unveiling of portraits of Dr. Leary and Dr. Cadis Phipps, professor of medicine. The anniversary exercises will conclude on October 6 with a general meeting at the John Hancock Hall, at which the speakers will include Dr. Leonard Carmichael, president of Tufts College, and Captain A. Warren Stearns, of the Medical Corps, U. S. Naval Reserve, dean of the medical school, now on military leave. Another feature of the celebration will be the release of a book on the history of the Tufts College Medical School, written by Dr. Benjamin Spector, professor of anatomy and professor of the history of medicine, which is said to be the first published history of the school.

IT is stated in *The Experiment Station Record* that under appropriations of the 1943 legislature additional substations have been established in Cumberland and Robertson Counties, Tennessee, the former to serve the Cumberland Plateau and the latter the Highland Rim region of middle Tennessee. This increases the number of experimental units in the state from five to seven and has led to the provision of an assistant station director. Frank S. Chance, superintendent of the Tobacco Substation at Greeneville, has been appointed to this position.

DISCUSSION

THE DISCOVERY AND DEVELOPMENT OF POTASH IN TEXAS AND NEW MEXICO PERMIAN

DR. J. W. TURRENTINE has recently issued through the American Chemical Society a book on "Potash in North America" reviewing the developments from 1924 to the present. In addition to the records he cites there, attention should be called to the contributions of some of the early workers in this field.

Dr. C. W. Dabney, former Assistant Secretary of Agriculture, writes to me that "the biggest find of potash was the one in the Texas-New Mexico Permian, discovered by Dr. J. A. Udden, geologist of the Bureau of Economic Geology and Technology of Texas and published in *Bulletin* 17, March 20, 1917, University of Texas." He describes this as "the first discovery of potash in Texas." Dr. Dabney presented a paper on the subject at the meeting of the American Association for the Advancement of Science, in December, 1923, at Cincinnati, Ohio.

Dr. W. B. Phillips, the chemist and director of the bureau, was at one time associated with Dr. Dabney in North Carolina. Dr. Dabney took a great interest in the search for American sources of potash and did everything in his power to interest the U. S. Geological Survey and to help the survey to obtain appropriations to make an adequate survey. The chief of the survey, George Otis Smith, sent a survey party to investigate. They reported that they found potash in some one hundred places where drillings had been attempted.

Udden's discoveries, according to Dr. Dabney, were fully described by Mansfield and Long in *Bulletin* 3401 of the University of Texas, and by H. I. Smith, of the U. S. Geological Survey, and in an article on "Potash in the Permian Salt Basin" in the *Journal of Industrial and Engineering Chemistry,* Vol. 30, page 854.

Dr. Dabney interested Senator Morris Sheppard and Representative Ganner in the subject and a bill authorizing $2,500,000 for surveys passed the Senate. The House Committee was ready to recommend a similar bill, but the Bureau of the Budget advised that the program was not in accord with the program of the President, so nothing further was done. What was accomplished was done with meager funds available from the U. S. Geological Survey and the State of Texas.

I am calling attention to these facts so that due credit may be accorded to these pioneer workers.

ALBERT F. WOODS

GRADUATE SCHOOL,
U. S. DEPARTMENT OF AGRICULTURE

"CHEMICAL" SEED TREATMENTS

AN item in SCIENCE-SUPPLEMENT of January 29, 1943, indicates that chemical treatment of seed offers little hope for increasing crop yields. Although the following context of the item makes it sufficiently clear to those familiar with the various types and purposes of seed treatment that treatment with growth-regulatory substances is in question, this item and others constantly appearing in the press indicate the need for more explicit reference to seed treatment if an important wartime contribution of science is not to suffer.

Several types of chemical seed treatments with several purposes are in common use or experimental stages to-day. Seeds may be treated with disinfestant chemicals to rid their surfaces of the organisms of disease and furnish chemical protection against such organisms in the soil; they may be treated with corrosive chemicals to alter the permeability of the seed coats and facilitate germination, a common practice in tree propagation; they may be treated with rodent-repelling chemicals as kerosene, turpentine or creosote; they may be chemically treated in the very doubtful, but commercially exploited, hope of thus imparting insect resistance to the resulting plants; they may be treated with growth-promoting substances in the expectation of thus increasing growth and yields; and leguminous seed are commonly treated with dusts containing nodule bacteria for increasing nitrogen fixation. It is important that these types of treatment be clearly differentiated in publicity.

Disinfestant seed treatments are of well-established value in the production of many crops and represent one of the most useful devices for increasing wartime production. It would indeed be unfortunate if the efforts of crop scientists and agricultural extension specialists to promote further adoption of them were to be thwarted by public statements, however correct, that chemical seed treatments (of certain other types) are useless or harmful.

K. STARR CHESTER

OKLAHOMA AGRICULTURAL AND
MECHANICAL COLLEGE

MINERAL DEPOSITS

MAY I make a suggestion that, if followed, may prove extremely valuable to our country and at the same time increase the contributions made by science to the war effort?

Vast quantities of ores and minerals are necessary to carry on the war. Commercial development after we win this war will likewise require mineral products in quantities that we may find difficult to supply.

Men in the Armed Forces will probably travel very nearly all over the world before the present war is finished. Would it not be wise, therefore, to give all officers of the Army and Marine Corps a short but intensive course in the recognition or identification of the ores of the more important metals. Thus equipped, they would constitute searching parties or prospectors, some of whom certainly might discover mineral deposits that would prove valuable or even vital to our cause. If all members of our Army and Marine Corps who will be going afield could be given this training, instead of just the officers, it should obviously increase our chances of finding these much-needed minerals.

Colleges and universities that teach geology, mineralogy, etc., could give such training, as could most commercial geologists and others who are familiar with rocks and minerals. If it is not practicable to give this training at the colleges and universities, then training centers manned by competent instructors could be set up in connection with already established Army and Marine Corps camps.

J. J. WOLFORD

MIAMI UNIVERSITY, OHIO

QUOTATIONS

THE RETIREMENT OF PROFESSOR RAYMOND C. ARCHIBALD

FEW scholars have a larger circle of personal friends among mathematicians on both sides of the Atlantic than Professor Raymond C. Archibald, whose impending retirement is announced from Brown University. An official position in the American Mathematical Society has brought him into touch with every active mathematician of this century in America, while in the course of frequent and extensive journeys in Europe to ransack bookshops and visit libraries, he has taken every opportunity to make the acquaintance in their own countries of the men and women whose writings he already knew. Enthusiastic, persuasive and learned, he has made the mathematical section of the library at Brown University one of the finest to be found anywhere, and he has created there for mathematicians the surest source of bibliographical and biographical information in the world.

Professor Archibald's published works include the definitive edition of one of Euclid's minor treatises, and the semi-centennial history of the American Mathematical Society, the latter a heavily documented volume incorporating twenty-seven biographical sketches. He is the author of a vast number of bibliographical articles, distinguished for an impersonal and uncritical thoroughness that conceals the toil and the knowledge that go to their compilation, and is, it must be confessed, sometimes carried to excess, for Archibald's modesty will not allow him to believe that if only, like Keynes and Muir, he would sometimes tell us after reading a paper that no one need ever read it again, others would gladly accept his judgment and be spared the tedium of making the discovery for themselves. Professor Archibald has served for long periods on a number of editorial boards, and is now editing for the National Research Council of the United States the youngest of mathematical journals, *Mathematical Tables and Aids to Computation.* To Professor Archibald, retirement will not spell indolence. It need scarcely be said that his expert advice will still be available in the library which he has made famous, he is continuing in his latest editorship, and he hopes to devote the time saved from routine to perfecting the organization of a library of English and American poetry and drama which he has been developing at Sackville since 1905 in memory of his mother. Increased leisure, if miraculously he achieves it, will mean enhanced opportunities to cultivate a second passion, for he is not merely a lover of music but also a musician of exceptional skill, who might easily have become a professional violinist and remained an amateur in mathematics. May he long enjoy a strenuous life.—*Nature.*

SCIENTIFIC BOOKS

THE BLOOD IN TUBERCULOSIS

Clinical Significance of the Blood in Tuberculosis. By Gulli Lindh Muller. Pp. xvii + 516. The Commonwealth Fund. 1943. $3.50.

Since medical monographs assume places of authority in medical knowledge they should meet two requirements. First, the scattered literature on a subject should be concisely and completely presented. Dr. Muller has performed a commendable and difficult task in this phase of her book, although citations and bibliography are not complete. Second, the observations of the author should be presented in such fashion that the reader can easily grasp the full significance of the data presented. In some instances Dr. Muller has failed to fulfil this requirement.

The emphasis placed upon *qualitative* changes in neutrophiles when the author states "the omission of shift in the neutrophiles in the description of a leukocytic picture is a gross error comparable to an examination of the heart without counting the pulse" is a case in point. Discussion of the data presented in the table on page 57 emphasizes that "shifts to the left" are commonly present in normal leukocytic counts (author's standard). Hematologists would agree that a percentage of 8 or more "band forms" is beyond normal limits. As I reported in the *American Journal of Medical Sciences* in January, 1929, the upper normal limit of neutrophiles is 65 per cent. Dr. Muller presents no data, either from her own studies or from the literature, to refute the reliability of my data. On the basis that above 65 per cent. of neutrophiles is abnormal, the table on page 57 shows that two thirds of the counts are abnormal and one third normal. In the abnormal range 46.5 per cent., and in the normal range 15 per cent., reveal an increase of "band forms." As the percentage of neutrophiles increases, especially above normal, the percentage of "shift to the left" increases. Without minimizing the significance of qualitative changes one may question the wisdom of insisting that Schilling counts be done on all leukocytic counts. A better policy would be to let the hematologist decide when Schilling counts are essential. Careful thought must be given to the diversity and quantity of laboratory tests recommended for a routine diagnostic service.

The rather lengthy dissertation on the eosinophile seems to be out of place since Dr. Muller states "eosinophilia . . . may anticipate an *improvement or a deterioration,*" *i.e.,* no definite interpretation can be given an eosinophilia *per se.* The suggestion that eosinophilia in tuberculous cases reflects "an allergic response" hardly seems valid, since only 20 per cent. of the cases exhibited an eosinophilia and probably the entire group would react to tuberculin.

Since hematologists agree that the percentage distribution of the different cell types is of paramount importance in leukocytic counts it would seem that the contents of Chapters 9 and 10 could be condensed to advantage. It is regrettable that Dr. Muller has not stressed the fact that a leukocytic count contains at least six variables and that it is the proportional relationship of the variables that constitutes the significance of any leukocytic count.

The chart shown on page 163 presents an interesting theoretical concept. It can not be accepted as factual for two reasons—first, it is extremely difficult to determine when a tuberculous individual has eradicated the tubercle bacillus from his system; second, to assume that a tuberculous infection may be "healed" because leukocytic counts remain within normal limits is unwarranted.

The occurrence of anemia in tuberculous patients is generally recognized and the need to determine the type of anemia is evident. Dr. Muller's presentation of this subject is valuable. A condensation of the text would enhance its value.

The sixty-page dissertation on the sedimentation rate of erythrocytes could be condensed considerably, thus emphasizing the salient facts. The correction table devised by Dr. Muller undoubtedly permits a more precise determination of the "rate of sedimentation." From a practical point of view the necessity for such precision may be debated. To the clinician the thing of importance is whether the rate is abnormal and, if so, how far it deviates from normal. In this respect the results should not be interpreted too finely—a difference of 0.5 mm per minute would be significant, whereas a difference of 0.2 mm would be equivocal. In a routine diagnostic service a single reading at one hour and a determination of the percentage of sedimentation based upon the plasma volume will give the clinician the essential facts, although admittedly this method does not guarantee the mathematical accuracy of Dr. Muller's method. Dr. Muller might have added to her requirements a uniform temperature for all sedimentation tests since temperature does affect the test to some extent.

In Part 4 Dr. Muller demonstrates that hematological and clinical findings often disagree, especially in individuals who seem to be progressing satisfactorily. It is where such disagreements occur that the hematological findings are of especial value. That the leukocytic reaction and the sedimentation rate are two independent phenomena which often disagree is also clearly demonstrated. This portion of the monograph would be improved greatly by a reduction in the number of tables and graphs. In some instances the number of patients and of serial tests is too small to carry much weight.

On page 311 Dr. Muller states: "The index is unfavorable in 37.8 per cent. of the examinations in Group A; as seen above these cases were clinically quiescent most of the time. Since there is an incidence of lymphopenia in only 14.1 per cent., and of neutrophilia in only 7.4 per cent., *the unfavorable index is obtained by the interpretation of essentially normal values.*" This interpretation is based upon the arbitrary normal values proposed by Dr. Muller, not upon the normal values which I reported in the *American Journal of Medical Sciences* in January, 1929. It is impossible to obtain an unfavorable index from normal leukocytic counts if the normal values I have determined are used. Furthermore, unless such normal values are acceptable the index values are not valid.

The reviewer is impressed by the fact that Dr. Muller considers changes within a rather narrow zone in Schilling counts and in sedimentation rates as significant, whereas rather broad changes must be present in a differential percentage before any interpretation is allowed. This is a common error among physicians and is due apparently to the difficulty of appreciating proportional changes between several variables. The entire purpose of the leukocytic index, as reported by the reviewer, was to demonstrate that proportionally the several variables could be abnormal in a leukocytic count that would ordinarily be accepted as normal.

Part 6 is well done. Dr. Muller could have insisted, with profit, on the counting of 400 cells to obtain a differential percentage to make the determination reliable statistically when different counts are to be compared. A reliable count can be obtained from a single well-made blood smear.

The general impression of the reviewer is that a much more concise monograph on this important subject would have evolved had the author had a much longer and broader experience in the field of tuberculosis.

E. M. Medlar

SPECIAL ARTICLES

AN EXPERIMENTAL TEST OF THE FRAMEWORK THEORY OF ANTIGEN–ANTIBODY PRECIPITATION

The framework theory (lattice theory) of serological precipitation and agglutination, first proposed by Marrack,[1] has not been accepted by all investigators in the field, although it is supported more or less strongly by a considerable body of evidence.[1,2,3,4] We have now carried out some experiments which correspond so well in their results with the predictions of this theory as to leave little doubt of its correctness.

---

[1] J. R. Marrack, "The Chemistry of Antigens and Antibodies," Report No. 194 of the Medical Research Council,

We have synthesized a substance which gives a specific precipitate with a mixture of two different antisera, but gives no precipitate with either antiserum alone. The substance contains two different haptenic groups, R and X, to which the two antisera are homologous: the anti-R serum was made by injecting rabbits with azoprotein containing R groups, and the anti-X serum by injecting with azoprotein containing X groups. The R and X groups were respectively the *p*-azophenylarsonic acid group and the *p*-azobenzoic acid group, and the RX substance used in most of our work was 1-amino-2-*p*-(*p*-azophenylazo)phenylarsonic acid-3,6-disulfonic acid-7-*p*-(*p*-azophenylazo)benzoic acid-8-hydroxynaphthalene. Similar results were also obtained with 1,8-dihydroxy-2-*p*-azophenylarsonic acid-3,6-disulfonic acid-7-*p*-(*p*-azophenylazo)benzoic acid-naphthalene.

The experimental results show that in the formation of the precipitate both of the two haptenic groups of the molecule enter into specific reaction, the R group with an anti-R antibody molecule and the X group with an anti-X antibody molecule. This is shown by the fact that the RX substance precipitates only with a mixture of the two antisera, and not with either one alone; the explanation of the failure of precipitation with only one antiserum given by the framework theory is that with respect to either antiserum the RX molecule is only monohaptenic and hence only univalent, and so can not act as the link between antibody molecules in the formation of a framework.

With the effective bivalence of the precipitating antigen thus proved, knowledge of the antibody-antigen molecular ratio for the precipitate provides the value of the average valence of the antibody molecules. The molecular ratio was found by analysis to be 0.7, which corresponds to $2/0.7 = 2.8$ for the average antibody valence.[5] If the antibody were univalent the molecular ratio would have the value 2, which is far greater than the experimental value. Further evidence for the effective multivalence of antibody is provided by the observation that the RX precipitate is soluble in excess of the mixed antisera; this solubility can not be explained on the basis of univalent antibody.

A detailed account of this work will be published in the *Journal of the American Chemical Society*.

Linus Pauling
David Pressman
Dan H. Campbell

Gates and Crellin Laboratories of Chemistry,
California Institute of Technology

His Majesty's Stationery Office, London, 1934; Second Edition, Report No. 230, 1938.

[2] M. Heidelberger and F. E. Kendall, *Jour. Exptl. Med.*, 61: 559, 563, 1935; 62: 467, 697, 1935; M. Heidelberger, *Chem. Rev.*, 24: 323, 1939.

[3] L. Pauling, *Jour. Am. Chem. Soc.*, 62: 2643, 1940.

[4] L. Pauling, David Pressman, Dan H. Campbell and collaborators, *ibid.*, 64: 2994, 3003, 3010, 3015, 1942; 65: 728, 1943.

[5] Similar values of the antibody-antigen molecular ratio have been previously reported (footnote 4) for precipitates of anti-R antisera and simple substances containing two or more R haptenic groups.

THE PRODUCTION OF MULTIPOLAR MITOSES IN NORMAL EMBRYONIC CHICK CELLS

The sporadic occurrence of an abnormal type of cell division, namely, multipolar mitosis, in normal somatic cells remains unexplained. Kemp[1] reported finding a single tripolar mitosis in approximately 10,000 dividing cells in tissue cultures of tissues from normal chick embryos and adult fowls. A later study[2] of dividing cells from a double monster (Cephalopagus) revealed five triasters among 500 mitotic cells. The fact that multipolar mitoses with resultant unbalance of chromosome number in daughter cells occur during the growth of certain types of malignant cells is too well known to be emphasized.[3, 4, 5, 6] However, the significance of their occurrence in relation to malignancy has not yet been established. Attempts to produce this type of cell abnormality in normal somatic cells have met with varied degrees of success.[7, 8, 9, 10]

In the present experiments 4 series of cultures (total 92) of eight-day normal embryonic chick heart muscle were made by the usual hanging drop technique. A total of 12 to 14 chick hearts were used. The culture medium consisted of 1 drop of fowl plasma (dil. 1:1 with Tyrode solution) and 2 drops of a mixture of embryonic juice from 8- and 11-day chick embryos (dil. 1:1 with Tyrode solution). The medium was renewed on the cultures of series 1 and 2 on the sixth day of cultivation; on those [illegible] ries 3 and 4 on the seventh day. Cultures of series 1 and 2 were fixed for cytological study on the seventh day of life *in vitro;* those of series 3 and 4 on the eighth day. The temperature for incubation was constant at a given point in the incubator but varied from 42+° C. at the back side to 37½° C. at the front. The heating units of the incubator consisted of two electric light bulbs (carbon). Consequently, light of a very low intensity was emitted intermittently. All cultures placed in the back half of the incubator were killed.

---

[1] T. Kemp, *Zeit. f. Zellforsch. u. mikrosk. Anat.*, 11: 429, 1930.

[2] T. Kemp and J. Engelbreth-Holm, *Arch. f. exp. Zellforsch.*, 10: 117, 1931.

[3] Th. Boveri, "Zur Frage der Entstehung der malignen Tumoren." Jena, 1914.

[4] M. Levine, *Jour. Cancer Research*, 14: 400, 1931.

[5] M. R. Lewis and L. C. Strong, *Am. Jour. of Cancer*, 20: 72, 1934.

[6] J. Maurer, *Arch. f. exp. Zellforsch.*, 21: 191, 1938.

[7] W. G. Whitman, *Am. Jour. of Cancer*, 17: 932, 1933.

[8] E. Marie Hearne Creech, *Am. Jour. of Cancer*, 35: 191, 1939.

[9] W. R. Earle and Carl Voegtlin, *Public Health Reports*, 55: 303, 1940.

[10] E. F. Stilwell, *Anat. Rec.*, 76: 205, 1940, and 84: 193, 1942.

Microscopic examination of cultures of series 1 revealed the presence of numerous multipolar mitoses (chiefly triasters) in 8 of the 12 cultures fixed and stained. In cultures of series 2, 3 and 4 frequent triasters and other aberrant forms of mitosis have been found in at least 2 cultures of each series. The abnormal division figures consist chiefly of: triasters (ana-, telo-, and reconstruction phases); cells with 3 poles and two spindles. "Resting" cells with two or more nuclei are of frequent occurrence; chromosome vesicles (16 in one cell) have been observed. The unusually large size of cells exhibiting these abnormalities is noteworthy. The cultures presented a very vigorous growth. Over 500 dividing cells were counted in culture 2 of series 1.

A detailed study of the cultures at hand is in progress and the results will be published elsewhere at a later time. From the results already obtained it is obvious that the possibility of repeated production of multipolar mitoses in normal somatic cells *in vitro* is an important point of departure for determining the significance of this phenomenon of cell growth in relation to malignancy. A program of experimental work designed to analyze the factors responsible for the production of these modified cells has been planned.

E. FRANCES STILWELL
DEPARTMENT OF ANATOMY,
WOMAN'S MEDICAL COLLEGE OF PENNSYLVANIA

THE ROLE OF NIGHT TEMPERATURE IN PLANT PERFORMANCE[1]

IN the course of observations of the responses of some 240 varieties or species of plants to different temperatures and photoperiods[2] chance evidences became increasingly suggestive that the temperature during the night rather than the daytime level largely determines the type of response which the plants make to temperature. Hamner and Bonner[3] have reported this is true in the case of *Xanthium* (cocklebur).

This past winter several species of plants were grown in four greenhouses at different temperatures, approximately as follows: cool (55° F.); cool/warm (55° F. at night and 75° F. in the daytime); warm/cool (75° F. and 55° F.); and warm (75° F.). Each house had provision for both long- and short-day treatments. Some of the reactions of the plants given warm nights and cool days will be reported briefly.

They were of a pale color, particularly those in short days. "Warm climate" plants as Proso millet, corn, hemp, Biloxi soybean and sorghum were particularly yellowish, some being near the color "Grapefruit."[4] "Cool climate" plants as oxeye daisy, timothy, rye, nasturtium, brome grass and blue grass, on the other hand, developed a relatively good green color in cool days following warm nights.

The plants with pale color because of cool days following warm nights made relatively little growth when compared to those with warm days, either with warm or cool nights. They did, however, have practically normal blossom induction reactions. This was true for such short-day plants as Biloxi soybean, hemp, pigweed, cocklebur, poinsettia, Refugee bean and Jimson weed as well as the long-day species alfalfa, beet and snapdragon. Indeterminate types, as tomato, Russian dandelion and Alaska pea, had a time schedule like the plants in the warm house.

The warm nights with cool days had an effect like the continuously warm environment of delaying or inhibiting the flowering of snapdragon, poinsettia and beets. Other effects which were comparable in these two temperature environments were a reduction in the setting of seed of Alaska peas, alfalfa and yellow sweet clover, delayed tuberization of potatoes, reduced root formation by Russian dandelions and a masking of potato virus symptoms.

Some cool temperature plants, as bluegrass, oats and barley, tend to head better in the cool day house with warm nights than when these are kept warm both day and night, but do not set seed well as in the cooler houses. It would appear possible to use such types and secure evidence that the daytime temperature is most important. Such a conclusion should await the results from carrying the day temperatures at a lower level than was used this season.

These limited preliminary observations indicate that for a number of plants at least, the temperature during the dark period of the day is an important factor affecting blossom induction as well as some other reactions.

R. H. ROBERTS
DEPARTMENT OF HORTICULTURE,
UNIVERSITY OF WISCONSIN

---

[1] Published with the approval of the director of the Agricultural Experiment Station.

[2] R. H. Roberts and B. Esther Struckmeyer, *Jour. Agr. Res.*, 56: 633–677, 1938; *ibid.*, 59: 699–710, 1939.

[3] Karl C. Hamner and James Bonner, *Bot. Gaz.*, 100: 388–431, 1938.

[4] A. Maerz and Paul M. Rea, "A Dictionary of Color." New York: McGraw Hill.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

MICROBIOLOGICAL DETERMINATION OF AMINO ACIDS

The authors have found that microbiological techniques similar to those used for vitamin assays can also be used for rapid and accurate determinations of amino acids. *Lactobacillus arabinosus 17–5* appeared to be the most satisfactory of a large number of organisms tested. The following amino acids were found to be essential for the growth of this organism: glutamic acid, tryptophane, threonine, valine, leucine, isoleucine, cystine, lysine and phenylalanine.

In addition, alanine, arginine, aspartic acid, histidine, proline, serine, methionine and tyrosine increased the growth of the cultures and hence were included in the medium.

When *p*-aminobenzoic acid was added to the Snell and Wright[1] assay medium for nicotinic acid, a mixture of the above amino acids was found to adequately replace hydrolyzed casein. The growth of the bacteria on the synthetic medium was further increased by a concentrate prepared from tomato juice as described below. This concentrate appears to contain an unknown growth-stimulating factor for *Lactobacillus arabinosus.*

The active material was adsorbed from clarified tomato juice with Norite A at pH 3. Elution was effected with a pyridine, ethanol, water mixture (in the ratios 1:2:1). The eluate was evaporated to dryness and the residue hydrolyzed with 8N H_2SO_4. After removing the H_2SO_4 with $Ba(OH)_2$ the adsorption and elution was repeated.

The complete medium as used for the determination of the amino acids is based on that of Snell and Wright[1] with the casein hydrolyzate replaced by 2 milligrams of each of the above-mentioned amino acids (except glutamic and aspartic acid, which were used at a 4 mg level) and 1 mg of Norite eluate per 10 ml of completed medium. Para aminobenzoic acid was also added to the medium.

By leaving out one of the amino acids which is essential for the growth of *Lactobacillus arabinosus,* a medium for the determination of that particular amino acid is prepared. The method of conducting the tests is essentially the same as is used for the determination of nicotinic acid, titration of the amount of lactic acid formed in the test cultures being indicative of the amount of the amino acid which is present in the unknown.

The authors have found the method particularly useful for the determination of valine, leucine and isoleucine. These amino acids are sharply differentiated biologically, although their chemical structures are so similar that accurate determination by chemical means is difficult.

Pure samples of these three amino acids are more readily obtainable as the synthetic *dl* forms. In the case of valine and leucine only the naturally occurring *l* forms are active, the *d* forms being completely inactive. The *dl* forms may be used as standards, two weight units of the *dl* form being exactly equivalent in activity to one unit of the pure *l* form. Standard curves for valine determinations cover the range from 0 to 0.08 mg of *dl* valine. For leucine the range is from 0 to 0.16 mg of the *dl* form. Synthetic *dl* isoleucine can probably be used as a standard as soon as studies concerning the specificity of the bacteria for the four forms of this amino acid are complete.

TABLE I

SPECIFICITY OF *Lactobacillus arabinosus* FOR THE OPTICAL ISOMERS OF SOME AMINO ACIDS

Amino acid	Optical form	Weight per test	Titration values,* 0.1 N NaOH	
		mg	*ml*	
Valine	....	0.00	0.56	0.54
Valine	d(−)	0.02	0.52	0.54
Valine	l(+)	0.02	2.17	2.19
Valine	dl	0.04	2.19	2.19
Leucine	l(−)	0.04	2.70	2.82
Leucine	dl	0.08	2.85	2.82
Glutamic Acid	l(+)	0.02	2.78	2.82
Glutamic Acid	dl	0.04	2.78	2.82
Lysine	l(+)	0.04	2.82	2.79
Lysine	dl	0.08	2.76	2.79

* 5 ml aliquots from 10 cc culture tubes.

Table I shows the specificity of *Lactobacillus arabinosus* for the optical isomers of some of the amino acids.

A detailed report covering the application of the method to the determination of amino acids in protein hydrolyzates will be published elsewhere in the near future.

K. A. Kuiken
William H. Norman
Carl M. Lyman
Fred Hale
Texas Agricultural Experiment Station,
A. and M. College of Texas

---

[1] E. E. Snell and L. D. Wright, *Jour. Biol. Chem.,* 139: 675, 1941.

BOOKS RECEIVED

Davis, A. F. and Powers, Ed. C. *Studies in Arc Welding.* Illustrated. Pp. xxxi + 1295. James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. $1.50.

Fulton, John Farquhar. *Physiology of the Nervous System.* Illustrated. Pp. ix + 614. Oxford University Press. $9.00.

Wahlstrom, Ernest E. *Optical Crystallography.* Illustrated. Pp. v + 206. John E. Wiley and Sons. $3.00.

Wood, Casey A. and F. Marjorie Fyfe. *The Art of Falconry.* Illustrated. Pp. cx + 637. Stanford University Press. $10.00.

SCIENCE

VOL. 98 FRIDAY, SEPTEMBER 24, 1943 No. 2543

Aristotle, Newton, Einstein: PROFESSOR E. T. WHITTAKER 267

The Longevity of the Eminent: DR. HARVEY C. LEHMAN 270

Obituary:

Bennie Wilbur Doane: JOHN M. MILLER. *Leslie Leland Locke:* PROFESSOR LOUIS C. KARPINSKI. *Recent Deaths* 273

Scientific Events:

The North Pacific Planning Project; Escuela Agricola Panamericana; The Chicago Museum of Natural History; The National Metal Congress; The Louis Livingston Seaman Fund; Need for Water-Insoluble Forms of Water-Soluble Vitamins 275

Scientific Notes and News 278

Discussion:

Twenty-Five-Year Effort at Saving Nature for Scientific Purposes: DR. VICTOR E. SHELFORD. *On Methods of "Starring" American Men of Science:* DR. C. A. BROWNE. *Clavacin and the Press:* PROFESSOR H. W. ANDERSON 280

Scientific Books:

Blood Groups and Transfusion: PROFESSOR WILLIAM C. BOYD. *Chemistry:* DR. R. E. POWELL 283

Special Articles:

The Serological Activity of Denatured Antibodies: J. O. ERICKSON and DR. HANS NEURATH. *Protective Effect of Separate Inoculation of Spotted Fever Virus and Immune Serum by Intradermal Route:* PROFESSOR L. ANIGSTEIN, MADERO N. BADER and GERALD YOUNG 284

Scientific Apparatus and Laboratory Methods:

Observations on the Biological Value of a Mixture of Essential Amino Acids: DR. ANTHONY A. ALBANESE and VIRGINIA IRBY 286

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

ARISTOTLE, NEWTON, EINSTEIN. II

By Professor E. T. WHITTAKER, F.R.S.

UNIVERSITY OF EDINBURGH

THE problem that now confronted physicists was this: How can local properties, such as a gravitational field, exist in space when the existence of an ether is not a permissible supposition? The answer was furnished, in 1915, by the "General Theory of Relativity" of Einstein. He discarded Gassendi's assumption that space was a uniform characterless vacuum, and postulated that it had a property of curvature, varying from point to point: and that just as (to make use of a rough analogy) a paramagnetic body when placed in a magnetic field tends to move from the weaker to the stronger places in the field, so a massive body in space might be pictured as moving from places of weak to places of strong curvature. The curvature, in fact, performs in general relativity the same kind of function as the density and rigidity of the ether did in classical physics; but, unlike the ether-properties, it does not come into conflict with the principle of relativity. In Einstein's conception, space is no longer the stage on which the drama of physics is performed: it is itself one of the performers; for gravitation, which is a physical property, is entirely controlled by curvature, which is a geometrical property of space.

In Einstein's theory of gravitation the Newtonian concept of force is completely done away with; a free particle moves in a path determined solely by the curvature-properties of space; it is, as the Aristotelians would say, in potency with regard to space, and things in a state of potency continually seek to become actualized. The changes of position of the particle, in their turn, bring about changes in the curvature of space, so that the particle and space together may be regarded as a single system whose evolution is determined by the law that the total curvature of space-time is to be a minimum: as we may say, gravitation represents a continual effort of the universe to straighten itself out—a statement so completely teleological that it would certainly have delighted the hearts of the Schoolmen.

While classical physics was thus being undermined by the principle of relativity, an even more devastating attack on it was developing from the side of quantum-theory. In 1913 a young Danish research student named Niels Bohr, working under Rutherford in Manchester, published some new and revolutionary ideas regarding the way in which light is generated. Let us take as the simplest example the generation of light by a hydrogen atom. This atom consists of a massive particle in the center with an electron circulating round it, just as the earth and the other planets move round the sun. Now in the solar system a planet may revolve at any distance whatever from the sun—that is to say, there is no restriction on the dimensions of the planetary orbits; and similarly, according to classical physics, the electron in the hydrogen atom might revolve at any distance whatever from the nucleus—the possible orbits would form a continuous sequence. Bohr, however, now put forward the suggestion that this deduction from classical physics is false, and that, in fact, only certain particular orbits are allowable; just as if in the solar system a planet could move in the orbit of the earth, or in that of Mars or Jupiter, but could not move in any orbit intermediate between these, such as the orbits in which the minor planets actually do move. When the electron is moving in one of the permitted orbits the atom is said to be in a stationary state; and the fundamental assumption of Bohr's theory is that the atom, when it is not emitting light, must always be in one or other of the stationary states, without the possibility of its being in any intermediate condition: the emission of light takes place when, and only when, the atom changes from one stationary state to another.

Bohr showed that his suggestion would explain many of the known features of spectra most admirably; but some serious objections could be brought against it, and one of them was that he could give no explanation of the process by which an atom in a state A is raised or lowered to another state B. In the change the electron must transfer itself from the orbit belonging to state A to the orbit belonging to State B; and according to the Gassendi-Newton doctrine, an object such as an electron can transfer itself from one position to another position only by traveling over the space between them, occupying in succession the whole continuous sequence of intermediate positions. Bohr, however, found it impossible to provide any description of the transference of the electron, and was compelled to renounce the attempt to explain transitions between stationary states. At the time, this was regarded as an imperfection in his work. In the light of our knowledge to-day, we take a very different view, and regard Bohr's renunciation as one of the most valuable and permanent features in his theory, and as a landmark in the history of science; for the subsequent development of quantum-mechanics has shown that his inability to trace the adventures of the electron between leaving orbit A and settling in orbit B was not due to any insufficiency on his part, but was inherent in the physical situation.

What is the difficulty? Is it that the mathematical operations required to calculate the motion are so intricate as to be beyond the skill of the best mathematicians? Or is it that owing to the imperfections of our laboratory apparatus we can not make measurements of sufficient delicacy to specify empirically the successive stages of the motion? No, the trouble is more deeply seated. Even if we could imagine an investigator capable of solving any set of mathematical equations whatever, and, moreover, possessing instrumental equipment of the highest refinement conceivable, even then the problem of depicting in terms of the concepts of classical physics the transition of the atom from one stationary state to another would be insoluble; and the reason is, that the process can not be described as a continuous movement of an electron in space. We are confronted by a theoretical impossibility, like the impossibility of expressing π as a rational fraction or the impossibility of constructing a regular heptagon with ruler and compasses.

The importance of this discovery is that it invalidates the presuppositions of the whole Gassendi-Newton doctrine. It shows that there are events in the physical world which can not be represented on the background of space and time.

It therefore becomes necessary to find a metaphysics different from that which has been associated with classical physics; for metaphysics must (as Aristotle held) originate with reference to physics, since it is the conceptual framework into which our experience of nature is to be fitted. The progress of science has destroyed the foundations on which natural philosophy has hitherto been grounded. How is the damage to be repaired?

Evidently space and time must be deposed from the dominant position which they held in Newtonianism, and relegated to a status more or less resembling that which they had in the Scholastic philosophy; and therefore we must now begin not with space and time, but with fundamental physical events, such as the one which has just been occupying our attention, namely, the assumption by the atom of its different possible stationary states. The atom, which has a potency of various states, is correlated to the states, as potency is to act. It endures as the atom, while it takes different states in succession. This is precisely the aspect of things on which Aristotle fixed his attention: that substratum which persists while receiving different determinations is what in the Aristotelian-Scholastic philosophy is called matter; whereas the structural principle, which is peculiar to each determination or state, is called form. The atom, then, is matter with respect to its states, which are forms.

The same principles can be applied in one of the most recent of physical theories, that of the nucleus of the atom. The nucleus is generally said to be composed of two kinds of elementary particles, called protons and neutrons; but in the quantum-mechanical theory of processes such as the emission of beta-rays, the proton and neutron are regarded as two "states" of a single entity, often called a "heavy particle." Here, then, the heavy particle would be "matter," and its determinations as a neutron or proton would be its two possible "forms."

Matter is correlated to form, as potency to act—notions which may again play an important part in the natural philosophy of the future, as they did in pre-Newtonian days.

In the light of the Aristotelian-Scholastic concepts, certain otherwise puzzling facts, which have been discovered in modern investigations, fall into their places as elements of a rational coherent system. Take, for example, the fact that all electrons have the same electric charge. For this, the classical theory of electricity has no explanation to offer: the law of interaction is that two electrified particles repel each other with a force proportional to the product of their charges and inversely proportional to the square of the distance between them; and this law is valid whether the charges are equal or unequal. Yet it is impossible to believe that the actual equality of the charges of electrons is a mere accident: it must be fundamental in the scheme of nature, and there must be a reason for it. How fundamental and necessary it is has been shown by a study of the forces by which atoms are held together so as to form molecules. Take, for instance, the hydrogen molecule, which is constituted of two hydrogen atoms, each atom consisting of a nucleus and an electron. If the two electrons are interchanged with each other, there is no change in the system, since the electrons are identical. From which feature of the situation, by following up its consequences in the light of quantum-mechanics, we can predict that a stationary state of the system exists which has less energy than the energy of the two atoms when separated: this stationary state corresponds to the stable hydrogen molecule.

In the proof, everything turns on the exact equality of the two electrons. If they had different charges, the binding force (which is purely quantum-mechanical) would not exist; and this is true of all those binding forces which are called "homopolar bonds" in chemistry. Thus the world would be a very different place from what it is, if all electrons were not identical.

But the matter is not yet exhausted. There is something more profound: electrons are indistinguishable in a still more rigorous sense. If two electrons are at one instant at places A and B, and at a later instant at places C and D, it is impossible to say which of the electrons at C and D is the one which was formerly at A—that is to say, an electron can freely exchange its recognizability with other electrons; it has no sameness of being, no proper identity, no separate history. Its selfhood is merged in an electronhood which it shares with all other electrons, and which is correlated to it as potency to act. From the philosophical point of view this is clearly important, for it necessitates a revision of the concept of individuality as applied to the elementary particles, and reopens, in connection with the most recent discoveries in physics, the question which engaged so much attention in the Middle Ages, regarding the nature of universals or general terms, which represent the common basis of a class of individual objects.

The transition which is now in progress from classical physics to a new natural philosophy conformable to relativity and quantum-mechanics is less violent than that which took place three centuries ago, when classical physics arose on the ruins of Aristotelianism, but it may prove not less significant. As we have seen, it involves a return to some fundamental Aristotelian notions, which have again become a living force; and this should lead to more intercourse and mutual understanding between men of science and philosophers; for of all types of philosophy, the Aristotelian-Scholastic is, in its principles, the most congenial to the scientific mind. Like men of science in all ages, the Schoolmen never doubted the existence of an objective world that was independent of human cognition; they were untroubled by difficulties such as those raised later by Berkeley, Hume and Kant; they looked outwards towards a reality external to themselves, and analyzed their experience of it. They held that all our knowledge is derived primarily through the senses, which come into direct contact with concrete things. The sense-impression is subjected to the operation of the active intellect, which throws light upon it, as it were, divesting it of its contingent elements and making it intelligible by drawing out the idea or concept contained in it. The idea so obtained is the means whereby knowledge is acquired. Thus the human intellect is capable of conceiving relations such as cause and effect, and of apprehending Being as such; metaphysics is possible, and completes physics by ascending to the true understanding of reality.

All this fits in very well with the scientific man's view of what metaphysics ought to be. But if the prospect of a movement in the direction of Aristotelianism is agreeable to the investigator of nature, it may prove not less so to the philosopher. For the Cartesian revolution, which dethroned Aristotle, severed the philosophic and scientific traditions from each other, and made it impossible to incorporate physics into an all-embracing doctrine of reality. The impoverished representation of the objective world which Descartes obtained by abstracting only its purely quantitative aspects was a soulless mechanism, composed of parts which had no function except to move each other about in space; and this function was itself philosophically inexplicable and had no relation to any ideas of value or purpose.

The inherent defects of Newtonianism, the result of its dependence on the concepts of Descartes and Gassendi, were perceived by Leibnitz. In his controversy with Clarke he discussed the tendency, which had become common in Newtonian circles, to conceive of the relation between God and the universe as analogous to that of a watchmaker to a watch which he has constructed, and which, having been set going, continues to function, for some time at any rate, without any necessity for the continued presence or attention of its originator. Such a conception led inevitably to the idea of an absentee God, who, having created the world, had left it to run its own course without further divine intervention and who was therefore for practical purposes non-existent. As Leibnitz saw, it is impossible to build any religion as a superstructure on a purely mechanical philosophy; and, in particular, Christianity, being an incarnational and sacramental religion, is incompatible with any view of the world which completely despiritualizes matter.

The debate between Leibnitz and Clarke took place in the lifetime of Newton, who, however, did not participate in it. Though profoundly interested in theology, he seems to have held that the physicist is not under any obligation to concern himself with metaphysics; he can give his undivided attention to investigating the laws which will enable him to predict phenomena, and can leave the deeper problems entirely out of account; he can make it his purpose to describe rather than to explain. This is one of the implications of his celebrated declaration *hypotheses non fingo*,[10] and it determined the attitude of his successors—that is to say, men of science since Newton have generally held that correct (even if in some respects limited) knowledge regarding physics can be combined with any views whatever on the fundamental questions of being and reality; that part of the world can be rightly understood without reference to the whole; that natural philosophy is independent of metaphysics.

In a restricted sense this doctrine is true. The fact can not be disputed that great discoveries regarding the behavior of the external world have been made by workers whose investigations in their field of research were not related in their own minds to any interest or belief outside it. But the effect of such segregated thinking has been to make science a departmental affair, having no influence on life and thought except indirectly through its applications. At the present time there is a movement in scientific circles aiming at securing for science a greater influence on human affairs, and even calling for a refounding of civilization on a scientific basis; but its advocates do not always understand that, as a necessary condition for the possibility of such a reform, science must be reintegrated into a unity with philosophy and religion.

THE LONGEVITY OF THE EMINENT

By Dr. HARVEY C. LEHMAN

OHIO UNIVERSITY

IN an article published in the *Journal of the American Medical Association*[1] Dr. R. A. Rendich states that the most prominent physicians—those whose death notices receive the most space in the *Journal*—die on the average 4.7 years earlier in life than do those whose demise receives only a bare mention. Although Rendich presents no data which would enable a critical reader to draw any valid conclusion regarding the statistical significance of this apparent difference in longevity, Rendich assumes that the most prominent physicians really are less long-lived than are somewhat less successful physicians and he assumes further that their shortened life is the price that the prominent physicians pay for success or prominence in the medical world.

In a subsequent study,[2] Mills, who analyzed 1,036 obituary notices which were published in the same journal, obtained a curvilinear relationship between mean age at time of death and the number of lines in death column notices. In interpreting his data, however, Mills centers his attention primarily on one end of his curve almost to the exclusion of the other, *i.e.*, on the fact that those physicians whose death notices contain 21 or more lines died at the mean age of 70.59 years. Mills pays scant attention to the fact that the physicians whose obituary notices contain only 2 lines died at the greater mean age of 71.28 years. The fact that Mills found a *curvilinear* relationship between mean age at time of death and the number of lines in death column notices should certainly have caused him to doubt the real significance of his findings. However, Mills displays no such doubt. The gist of Mills's one-sided conclusion is summarized by him in the following words: ". . . the great seem not so inclined to die young or break down in the struggle as are the somewhat less successful; instead, their heritage appears more likely to be a ripe old age."[3]

---

[1] R. A. Rendich, *Jour. Am. Med. Asn.*, 119: 1041, 1942.

[10] "Principia," *Schol. gener. sub finem.*

[2] C. A. Mills, SCIENCE, 96: 380–381, 1942.

Mills and Rendich both seem to assume that the number of lines devoted to one's obituary is a valid measure of greatness or eminence, and both of these investigators assert that the longevity of the very eminent differs markedly from the longevity of those who are somewhat less successful. Nevertheless, these two workers arrive at diametrically opposed conclusions.

For a number of years the present writer has been studying the chronological ages at which outstanding leaders are most likely to reach the high points of their careers.[4] He has studied also the chronological ages at which various kinds of creative thinkers are most likely to accomplish those things which enable them to attain eminence.[5] In making the foregoing studies, statistical distribution tables were assembled which set forth both the ages of attainment and also the ages at time of death for almost 200 different groups of eminent individuals. Since the foregoing data were already assembled for the above-mentioned purpose, it was a relatively simple task to compute for each of these groups of exceptional individuals both the mean age at time of accomplishment and the mean age at time of death. What is found when data for this large number of groups are examined?

(1) The longevity of groups of eminent individuals who were born prior to about 1775 was compared with the longevity of other groups of eminent individuals (in the same fields of endeavor) who were born from 1775 to 1850. In some instances the earlier-born groups were found to exhibit greater longevity and in other instances the later-born groups displayed greater longevity. On the whole, however, there was no consistently reliable difference between the longevity of the later-born and the earlier-born groups.[6]

(2) Nineteen different comparisons were made between groups of creative thinkers who are recognized by experts as topflight performers and other groups of creative thinkers in the same fields of endeavor who are somewhat less eminent. No consistent differences in longevity were found.

(3) A careful study was made of the longevity of various types of eminent individuals—musicians, inventors, mathematicians, and so forth. Differences in mean age at time of death were found for these various groups, and some of these differences were statistically significant. For example, the composers, the poets and the painters in oil seemed to be somewhat less long-lived than the other groups with which they were compared. However, the group differences in longevity within a given field of endeavor were fully as great as were the median group differences among the different fields.

Thus, for 19 groups of painters in oil the mean age at time of death for the median-lived group was 59.14 years. And for 33 groups of scientists, mathematicians and inventors, the mean age at time of death for the median-lived group was 66.05. The median-lived group of scientists *et al.* thus lived on the average 6.91 years longer than did the median-lived group of painters in oil. But the difference in the mean longevity of the longest-lived and the shortest-lived groups of oil painters was 9.92 years. Similarly, the difference in the mean longevity of the longest-lived and the shortest-lived groups of scientists was 6.02 years. Numerous other such comparisons as the foregoing led to the conclusion that, within a given field of endeavor, the group differences in longevity are fully as great as are the group differences from field to field.

(4) For 35 groups of leaders (political, religious, judicial, legislative, military, educational and the like), the correlation between mean age at time of qualifying for membership in a particular group and mean age at time of death was found to be + .89. When 5 of the foregoing 35 groups were excluded from the computation[7] because these 5 groups seemed to have produced a spuriously high positive correlation, the resultant r dropped to + .70. This fairly high positive correlation suggests that various leaders have exhibited much of their longevity prior to qualifying for membership in their particular group.

---

[3] *Ibid.*, p. 381.

[4] H. C. Lehman, *Scientific Monthly*, 54: 162–175, 1942.

[5] H. C. Lehman, SCIENCE (in press).

[6] *Cf.* in this connection, E. G. Dexter, *The Independent*, 118: 185–187, February 12, 1927.

[7] These 5 groups consisted of hereditary sovereigns, born long ago, who had attained their thrones at quite early ages and who also had died at relatively youthful ages.

For example, the average age at time of death for the 29 Presidents[8] of the United States who have died is 68.3 years. The men who become this country's chief executives must, in the very nature of things, be a relatively long-lived group, for no one is elected to this high office until he has reached middle age at least. The state governors of the United States, born prior to 1850, have died at a lower mean age than have the Presidents, but these state governors have also been elected to their governorships at younger age levels. It seems clear, therefore, that any comparison with respect to the longevity of these two groups will be of doubtful significance until mean age at time of entry to the group in question is taken into account. Similarly, the positive *r* of +.70 between mean age at time of qualifying for membership in a given group of leaders and mean age at time of death, suggests that no wholesale comparison of the longevity of groups of leaders will be very meaningful until the mean age at time of entry into each group has been allowed for.

Table 1 sets forth the mean ages in years at time of death for 25 groups of eminent individuals. At the top of the list is a group of 248 cabinet members of the Presidents of the United States. For these 248 cabinet members the mean age at time of death was 71.39 years. At the bottom of this same list is a group of 213 hereditary European sovereigns who died at the mean age of 49.14 years. For the 248 cabinet members and the 213 hereditary sovereigns the mean difference in longevity is 22.25 years, and this difference is statistically reliable, the critical ratio being 15.76. Must one infer that the lesser longevity of the hereditary sovereigns is the price that was paid by these individuals for being hereditary rulers? This latter conclusion does not necessarily follow. The 248 cabinet members were first sworn in at the mean age of 51.21 years, whereas the hereditary rulers qualified for membership in their particular group at the mean age of only 30.00 years. For these two groups the difference in their mean ages at time of entry into their respective groups is thus 21.21 years; almost the same number of years as the difference in their longevity, namely, 22.25 years. Indeed, when the average cabinet member was first appointed he was already older than was the hereditary ruler at time of death. These data, therefore, may merely reflect the obvious fact that it is impossible for those who die young to become members of the President's cabinet in the United States. Certainly, a group of individuals who have died at the mean age of 49.14 years could not have qualified for any office at the mean age of 51.21 years.

TABLE 1

MEAN AGES IN YEARS AT TIME OF DEATH FOR VARIOUS TYPES OF EMINENT INDIVIDUALS

	Type of worker	Longevity Mean	P.E. of Mean
248	Members of the President's Cabinet in the U.S.A.	71.39	0.721
202	Entomologists	70.99	0.825
402	Inventors	70.96	0.628
211	Historians	70.60	0.801
249	American College and University Presidents	70.11	0.786
236	Geologists	69.79	0.855
216	Chemists	69.24	0.956
405	Educational Theorists	69.06	0.602
1,172	Educators, all kinds*	68.98	0.371
423	Economists and Political Scientists	68.68	0.596
537	Contributors to Medicine and Public Hygiene	68.57	0.560
221	Botanists	68.36	0.898
807	Philosophers	68.22	0.472
203	Historical Novelists	67.89	0.928
413	State Governors (U.S.A.)	67.02	0.597
757	Authors of Words to Church Hymn Tunes	66.94	0.545
177	Mathematicians	66.62	1.107
357	Composers of Grand Opera	66.59	0.737
273	Composers of Choral Music	66.51	0.816
274	Composers of Chamber Music	66.26	0.717
407	Naval and Military Commanders (born from 1666 to 1839)**	66.14	0.689
244	Authors of Political Poetry	64.47	1.011
305	Painters in Oil	64.22	0.763
543	British Authors†	63.91	0.648
213	Hereditary European Sovereigns	49.14	1.146

* These data were obtained and published by G. W. A. Luckey, *School and Society*, 28: 244–248, 1928.

** For 309 Naval and Military Commanders born prior to 1666 the mean age at time of death was 55.69 years.

† The list of British authors includes numerous poets.

W. R. Miles[9] reports the following data regarding the life-spans of certain eminent Greeks:

> I will mention four professional groups for each of which the number of cases is not too trivial: 38 philosophers lived on the average to 78.8 years, 26 writers (poets) 79.3 years, 25 writers (historians, critics) 78.4 years, and 10 orators, 71.6 years. The average was 77 years and 45 per cent. of the group reached the 80-year mark.[10]

Although the number of his cases is not large, it is noteworthy that *each* of the four groups mentioned by Miles exhibited greater longevity than *any* of the 25 groups for which data are presented in Table 1. Does this difference in longevity signify that the ancient Greeks were hardier individuals who lived longer than we moderns because of their greater hardiness? Not necessarily. The difference in the mean life-spans of Miles's 4 groups of ancient Greeks, as compared with the 25 more modern groups for which data are presented in Table 1, may be due merely to what this article has emphasized repeatedly, namely, *differential selective factors.* That is to say, this difference in longevity may have resulted from a difference in the selective factors operating then and now. It may well be that, in the recent past, an individual could attain eminence in intellectual fields at a more youthful chronological age than he could during the time of the early Greeks. The age-curves which accompany a recently published article[5] lend some support to this hypothesis.

---

[8] Because of their small number, the Presidents of the United States were not included in the 35 groups of leaders.

[9] W. R. Miles, SCIENCE, 81: 79–87, 1935.

[10] *Ibid.*, p. 381.

Table 2 sets forth, for six types of creative thinkers, the *r* between mean age at time of accomplishment and mean age at time of death. None of the 126 groups for which data are presented in Table 2 contained less than 50 individuals. It will be noted in Table 2 that in each instance the *r* between mean age at time of achieving and mean age at time of death is positive. These positive *r*'s suggest once again that the conclusion already stated with reference to leaders holds also for the 126 groups of creative thinkers, *i.e.*, that if one is to understand the real significance of whatever relationship may be found between longevity and superior performance, it will first be necessary to take accurate account of the mean ages at which the creative thinkers have demonstrated their superiority. In so far as the present writer is aware, this has never been done and, except for calling attention to the problem, no attempt has been made to do this in the present study.

TABLE 2

THE CORRELATION BETWEEN MEAN AGE AT TIME OF DEATH AND MEAN AGE AT TIME OF ENTRY TO VARIOUS GROUPS OF EMINENT INDIVIDUALS

Type of worker	*r*
21 groups of composers	+.46
11 groups of philosophers	+.31
19 groups of oil painters, etchers, etc.	+.61
20 groups of scientists, mathematicians, inventors ...	+.24
13 groups of contributors to medicine, surgery, etc. ..	+.93
42 groups of authors	+.56

OBITUARY

RENNIE WILBUR DOANE

1871–1942

THROUGH the death of Rennie Wilbur Doane on December 1, 1942, the science of entomology lost one of its most valued workers in both its teaching and its applied phases. His work in applied biology began at a time when economic entomology was entering a period of expansion in many of its useful fields of service. It was characteristic of the man that he should have chosen entomology as a career during one of its formative periods and that the record of his life has been one of pioneering effort. His interests have been broad, rather than specialized, and his contributions to his chosen work have been many and varied.

Mr. Doane was born in Des Moines, Iowa, on March 11, 1871. As a boy he moved with his parents to Kansas and later to Southern California, where he received his earlier schooling. He was twenty years of age when a new university on the Pacific coast, Stanford, was opened in 1891; and he entered with its first freshman class. As a self-supporting student, he found it necessary to interrupt his university course by one year of outside employment, but he returned to complete his collegiate work and graduate in 1896.

English literature was first selected by Mr. Doane as his major, but in his elective courses he was attracted by the men of the Stanford faculty who were teaching the biological sciences. In addition to David Starr Jordan, he came under the influence of J. H. Comstock, professor of entomology; and V. L. Kellogg, assistant professor. It was the stimulation of these men that led him to change his major to zoology and entomology in 1894, and it was from this department that he received his degree. Later he returned for graduate work, and it can be said that it was the influence of Vernon Kellogg which had much to do with the outlook upon entomology which was formulated by Mr. Doane during his undergraduate and graduate studies and his first years of teaching.

Following his graduation he went to Washington State College, where he taught zoology and entomology from 1896 to 1901, rising to the rank of assistant professor. It was while here that he married Elanora Cooper in 1898, who now surives him. His next position was that of superintendent of the Fisheries Experimental Station located at Keyport, Wash. Much of his work at this station from 1901–1903 was concerned with research dealing with the propagation of the native oyster, an important natural resource of the state of Washington.

In 1905 Professor Doane returned to Stanford, where he was to play an important part in the development of economic entomology on the Pacific coast. He first entered the faculty as instructor and curator in entomology, which then had the status of a department under Vernon Kellogg. In 1920, when Dr. Kellogg resigned to become a member of the National Research Council, entomology at Stanford was incorporated with the department of zoology and Mr. Doane was named associate professor. In 1926 he became full professor of zoology (entomology) and continued in this position until 1937, when he retired as emeritus professor.

Throughout his career at Stanford, Professor Doane was active in assignments which called for the exploration of new and varied problems in applied entomology. One of the first of these was in 1908, when he made an investigation of the insect pests of cocoanut trees in the Society Islands. The most important problem encountered on this trip was that of a scale insect, *Aspidiotus destructor*. In 1913 he was called to the Samoan Islands on a similar study for the copra industry in which the most important insect pest proved to be a rhinoceros beetle, *Orycetes rhinoceros*.

It was in 1908 that Professor Doane began a study of insect problems connected with the destruction of plant life in the vicinity of industrial plants in the western United States. These problems were for the most part localized around the ore-smelting and chemical plants in the mining districts. He became a recognized authority in this field and his services as consulting entomologist were often requested by industrial corporations. Yet another phase of applied entomology that drew his interest was the control of mosquitoes in the San Francisco Bay area, where for many years he was chairman of the Matedero Mosquito Abatement District.

In taxonomic entomology Professor Doane was interested in Diptera and very early in his work specialized in the Trypetidae and Tipulidae. While at Washington State College he brought together large collections of both families and described many new species. He continued his work on this group while at Stanford, where he described a number of new species of Tipulidae, some of which were of economic importance.

Professor Doane is remembered by his students as an energetic, kindly instructor who was always ready to guide and help them in the acquisition of useful knowledge. In 1908 there was a small group of advanced students at Stanford who were planning to enter forestry and desired instruction in forest entomology. To accommodate this group he instituted a course in forest insects, based primarily upon the insect problems in western forests. This was one of the first, if not the first, courses in forest entomology set up by any of the larger universities in the west; and in its first year it called for the cooperation of class and instructor in getting the most out of the material available. The course was developed and continued throughout the remainder of his teaching career. Later, as forest entomology became recognized at other schools on the Pacific coast, Professor Doane took the leadership in combining under joint authorship with E. C. Van Dyke, W. J. Chamberlain and H. E. Burke a text-book, "Forest Insects," which was published in 1936.

The teaching of entomology in its application to diseases that affect man was among the more important courses which he covered during his long career at Stanford. This subject formed the material for his first book, "Insects and Disease," which was published in 1910. In 1915 he published with Dr. Kellogg a text-book, "Economic Zoology and Entomology." "Common Pests," a reference book dealing with insects and other pests affecting man, was published in 1931.

Both in his teaching and in his writing, Professor Doane possessed the facility to express technical material in clear, simplified language. A list of his publications prepared by Dr. G. F. Ferris shows a list of fifty articles and books. The published papers covered his taxonomic work on the Tipulidae and Trypetidae, the results of his investigations of insect enemies of the cocoanut palm, an article on the mosquitoes of the Society Islands, an article on mosquito control and several papers on western forest insects.

He was a member of a number of scientific societies, including the American Association for the Advancement of Science, the American Association of Economic Entomologists, the Ecological Society of America and the Sigma Xi.

The last years of Professor Doane's life were troubled by frequent periods of illness, but these did not break his always forward outlook or his enthusiasm in planning for things ahead. Among his most characteristic qualities were his energy and his tenacity in completing those tasks which he considered worth while. He always took a deep personal interest in the welfare of his students that followed them into the later walks of life. His wide background of experience and inborn kindliness made him a valuable counselor to all those who came within his influence. Once he recognized promise and worth in those with whom he worked, his loyalty and sympathy never faltered.

JOHN M. MILLER

U. S. BUREAU OF ENTOMOLOGY AND
PLANT QUARANTINE,
UNIVERSITY OF CALIFORNIA AT BERKELEY

LESLIE LELAND LOCKE

LESLIE LELAND LOCKE, long well known as an authority upon the history of mathematical instruments, in particular the Peruvian quipu and calculating machines, died at his home in Brooklyn at the age of sixty-three years, on August 28, 1943.

In addition to many scientific articles in mathematical journals, Professor Locke wrote an authoritative work, "The Ancient Quipu or Peruvian Knot Record," published in 1923 by the American Museum of Natural History, with a supplement in 1928.

His collection of early calculating machines was presented by Mr. Locke recently to the Smithsonian Institution. Valuable early American text-books were presented by Mr. Locke to the University of Michigan.

After graduation at Grove City College and postgraduate work at Grove City College (A.M. in 1900), Pennsylvania State College, Cornell University and Columbia University, Mr. Locke taught at Michigan State College, before establishing his teaching in

Brooklyn. First at Adelphi College, and then for twenty-two years at Brooklyn College and the Technical High School, Mr. Locke established a reputation both as an able teacher and a learned investigator and writer on the history of mathematics.

LOUIS C. KARPINSKI

RECENT DEATHS

DR. JOHN M. MACFARLANE, since 1920 professor emeritus of botany of the University of Pennsylvania, died on September 16 at the age of eighty-seven years.

DR. FREEMAN WARD, professor of geology and head of the department of geology of Lafayette College, died on September 14. He was sixty-four years old.

DR. IVON R. TAYLOR, associate professor of psychology at Brown University, died on September 20. He was forty-five years old.

DR. CHARLES E. RESSER, since 1914 assistant curator of paleontology and curator of invertebrate paleontology and paleobotany at the Smithsonian Institution, died on September 17 at the age of fifty-four years.

HAL W. HARDINGE, mining and metallurgical engineer and inventor, died on September 15. He would have been eighty-eight years old on September 30.

SCIENTIFIC EVENTS

THE NORTH PACIFIC PLANNING PROJECT

AT a meeting last August, according to *The New York Times*, the National Resources Planning Board suggested to the co-chairmen of the Joint Economic Committees of the United States and Canada that the possibilities of the North Pacific region would merit careful study. As a result the two nations have begun the North Pacific planning project, the first step of which is to study the area preliminary to considering proposals for developing its resources, improving living standards and increasing the population, now about one hundred thousand.

The joint committees decided to sponsor such a survey, and the following aims have been announced:

(1) Enhanced security for Alaska, Canada and North America through well-conceived development of the North Pacific.

(2) Positive and active use of the area as a strategic key in a post-war system of world security.

(3) Development of the resources and transportation advantages as contributions to a better balanced continental economy.

(4) Development of economic opportunity for demobilized service-men and others who are adaptable to the region.

(5) A demonstration of the potential benefits of international collaboration in the development of backward and unoccupied areas; a testing of the various devices for implementing collaboration between all the governmental and corporate organizations and commissions and treaties between the two nations.

The United States National Resources Planning Board has provided the full-time assistance of its Alaska regional office staff, with headquarters at Portland, Oregon. James C. Rettie, of Portland, has been designated United States co-director. Actively participating are the Departments of State, Agriculture and Interior and the Board of Economic Warfare, together with Federal and territorial agencies in Alaska.

For Canada, Dr. Charles Camsell, deputy minister of the Department of Mines and Resources, has been named Canadian co-director, with agencies of the Dominion and of the provincial government of British Columbia cooperating.

The specific boundaries of the territory to be considered have not yet been clearly defined, pending the outcome of the study. Mr. Camsell said that the territory embraces part of Alberta, the northern half of British Columbia, the Yukon Territory, Alaska and the Mackenzie River portion of the Northwest Territories. He said that the eastern boundary would take in all territory which had any bearing on the economic aspect of the new Canada-Alaska highway and its related air routes.

ESCUELA AGRICOLA PANAMERICANA

THIS institution, situated twenty-five miles from Tegucigalpa, capital of the Republic of Honduras, opened its doors on September 1 with seventy-four students representing seven countries—Mexico, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama. Its establishment was made possible by a gift of $500,000 from the United Fruit Company of Boston. It is governed by a board of directors composed of Samuel Zemurray, president; W. Latimer Gray, secretary-treasurer; Thomas Barbour, Thomas D. Cabot and T. Jefferson Coolidge. Operation is carried out through a board of regents, of which the members are Wilson Popenoe, chairman; Fernando Castro C., Luis Landa, Carlos Mirón, Doris Zemurray Stone, W. L. Taillon and Walter E. Turnbull.

All students enjoy full scholarships, including transportation from their homes to the school, board, lodging, clothing, laundry service, medical attention and tuition. Equipment includes 3,500 acres of land, lying between 2,500 and 5,000 feet in elevation; a main building to be known as "Zemurray Hall" (not yet completed); dormitories, a dining hall, residences for the staff, a modern dairy and cold storage plant and various minor structures.

In founding Escuela Agrícola Panamericana it was the purpose of the United Fruit Company to cooperate in a practical manner toward the further development of agriculture in the Latin American countries. To this end the school will not only furnish instruction to a considerable number of Latin American (chiefly Central American) youths, but also will conduct experiments, especially with a view toward the introduction of new crop plants and improved varieties of those already cultivated, the diversification of tropical American agriculture and the improvement of the tropical dietary.

In choosing the teaching staff, especial care has been taken to select men with long practical experience in tropical agriculture. The department of agronomy and soils is headed by Alfred F. Butler; that of livestock and dairying by E. A. Rivera; and that of agricultural engineering by H. A. von Wald. Juvenal Valerio R., formerly director of the Museo Nacional at San José de Costa Rica, is professor of natural sciences, and Augusto Arís de C. is professor of English. Instruction during the first year centers mainly upon mathematics, English and the natural sciences. All students do classroom work only in the afternoons, the mornings being spent in field practice. The full course will require three years, following which an opportunity for specialization will be given those students who have demonstrated unusual ability.

WILSON POPENOE,
Director

THE CHICAGO MUSEUM OF NATURAL HISTORY

FOLLOWING are excerpts from the address of Stanley Field, president of Field Museum for the past thirty-five years, as delivered before the audience attending the ceremonies marking the fiftieth anniversary of the founding of the museum, held on the evening of Wednesday, September 15, in the James Simpson Theater of the museum:

> At this time I have the privilege of making two important announcements. First: Mr. Marshall Field, grandson of the founder, has advised the trustees of his intention to give to the museum certain pieces of property that should produce an income at least equivalent to what his annual contributions have been in recent years. Mr. Field has been very generous to the museum; he has financed expeditions, purchases of collections, maintenance of the building and operating expenses, and is solely responsible for the pension plan which makes liberal provision for all the employees; without his aid and the great interest he has taken in all its activities, the museum could not have reached the splendid position it occupies to-day. His contributions total $2,852,000, without any reference to the gifts he is now proposing to make, so you can see what an important part he has played in the growth and standing of the museum.
>
> While the gift of Mr. Field is very substantial, it is only his part in providing for a future which we hope may be on a scale suited to the standing of the institution, and to the importance of the great public and territory which it serves.
>
> The museum must therefore look to other public-spirited citizens in the future as it has in the past, for continued contributions to its support and development.
>
> ### CHANGE OF NAME
>
> My second announcement has to do with the name of the museum. The museum has had three names: Columbian Museum of Chicago—Field Columbian Museum—and Field Museum of Natural History. Mr. Marshall Field has discussed with me several times the matter of the name of the museum. He has felt that since the museum was created and maintained for the public and has become identified in the minds of the public as a Chicago institution, and since it is now playing a growing and important part in the educational activities of the city—it would be appropriate, and also in the best interests of the museum, if the name were changed to Chicago Museum of Natural History, thereby identifying its ownership more closely with the public of Chicago to whom, of course, it has always belonged.
>
> It seemed to both of us that the occasion of the fiftieth anniversary was the logical time to announce the change. Accordingly, the matter has been fully discussed with the Board of Trustees, has met with their unanimous approval, and they have authorized me to make this announcement to you.
>
> The change will become effective as soon as legally possible.

THE NATIONAL METAL CONGRESS

A SERIES of seventeen practical sessions on production, conservation and post-war planning in the metal industry have been announced by W. H. Eisenman, national secretary of the American Society for Metals, for presentation during the National Metal Congress and War Conference Displays in the Palmer House, Chicago, during the week of October 18. These sessions will provide a central clearing house for the practical solution of production problems, of conservation demands and of many post-war problems.

There will be a session on Wednesday afternoon, October 20, on Post-War Planning in the Non-ferrous Metals. A discussion on Thursday afternoon, October 21, will concern fundamental changes that may reasonably be expected in metallurgy and metals generally. On the same afternoon, a simultaneous session will deal with light-weight construction for the post-war era.

The seventeen sessions will open on the afternoon of October 18, with a discussion of advanced quenching practice. The purchase of steels on expected performance which is the European practice rather than on chemical analysis, as used in this country, will be considered at one of the evening sessions on Monday, with the other simultaneous sessions devoted to nondestructive tests. Powder metals, products that have really come into their own during the war, will be discussed on Tuesday afternoon, October 19. Simultaneous sessions the same afternoon will deal with special alloy addition agents for steel, with another session on steel-making methods scheduled for Tuesday evening. Another Tuesday afternoon session will be on foundry metallurgy.

On Wednesday afternoon, October 20, in addition to the session on post-war planning in non-ferrous metals, a simultaneous session will take up modern practices in surface hardening. Another session on Wednesday afternoon will deal with control of quality by inspection. This session will also take up the personal equation in inspection, precision measurements and the statistical analysis of test results. A session in the afternoon will deal with control of quality by inspection. National emergency steels will occupy the session in the evening. Use of these new steels in aircraft and engines, as well as their general utility, will be discussed.

Salvaging metals, including the recovery of battlefield scrap, will be discussed in one of the simultaneous sessions on Thursday afternoon, October 21.

Magnesium and magnesium alloys will be the subject of one of the final sessions on Friday afternoon, October 22. "The Working of Magnesium," a film of the Dow Chemical Company, will be shown. The other session will deal with special finishes and metallic protection.

War production sessions will be held each afternoon and evening during the week, except Thursday and Friday evenings, in the Palmer House, where more than one hundred and sixty manufacturers will have war conference displays. The technical and professional programs of the society will be held each morning.

THE LOUIS LIVINGSTON SEAMAN FUND

THE New York Academy of Medicine announces the availability of the Louis Livingston Seaman Fund for the furtherance of research in bacteriology and sanitary science. One thousand dollars is available for assignment in 1943. This fund has been made possible by the terms of the will of the late Dr. Louis Livingston Seaman, and is administered by a committee of the academy under the following conditions and regulations:

(1) The committee will receive applications either from institutions or individuals up to November 1, 1943. Communications should be addressed to Dr. Wilson G. Smillie, chairman of the Louis Livingston Seaman Fund, 1300 York Avenue, New York City.

(2) The fund will be expended only in grants-in-aid for investigation or scholarships for research in bacteriology or sanitary science. The expenditures may be made for: (a) Securing of technical help. (b) Aid in publishing original work. (c) Purchase of necessary books or apparatus.

NEED FOR WATER-INSOLUBLE FORMS OF WATER-SOLUBLE VITAMINS

THE practicable enrichment of corn grits and white rice with certain vitamins would be greatly facilitated if insoluble forms of thiamine, riboflavin and niacin were available. Whereas the soluble forms of these factors are entirely suitable for the enrichment of white flour and of many of the cereal breakfast foods, the customary culinary methods widely prevalent in this country make these water-soluble forms less suitable. Corn grits and white rice, for example, are often subjected to rinsing before cooking. Thus water-soluble vitamins sprayed on the exterior surfaces of these particles would be washed off and lost in the discarded rinse water. In the face of this situation methods are in process of development for impregnating the water-soluble vitamins within the interior of special granules of size and texture approximately comparable to the hominy grits or white rice, respectively, but that method has certain disadvantages.

Cognizant of the importance of this situation, the Committee on Cereals and the Food and Nutrition Board of the National Research Council at their meeting on September 1, 1943, made the following proposal:

> The food and nutrition board commends to the attention of laboratories of the chemical and cereal industries and to those of universities and experiment stations the desirability of developing insoluble salts or derivatives of thiamine, riboflavin and niacin, capable of being fixed upon the surfaces of cereal particles in physiologically active form and in a manner to avoid loss by rinsing. Such developments would be of peculiar value in the enrichment of white rice and corn grits.

FRANK L. GUNDERSON,
Executive Secretary

FOOD AND NUTRITION BOARD,
NATIONAL RESEARCH COUNCIL,
WASHINGTON, 25, D. C.

SCIENTIFIC NOTES AND NEWS

Cornelius Francis Kelley, chairman of the board of directors of the Anaconda Copper Mining Company, has been awarded the Charles F. Rand Memorial Medal for "distinguished achievement in mining administration" by the American Institute of Mining and Metallurgical Engineers. Presentation of the medal will take place at the annual dinner meeting on February 22, 1944.

A testimonial dinner in honor of Major General James C. Magee, whose term of office as Surgeon General of the Army expired on May 31, was given at the Statler Hotel in Washington, on May 25. About two hundred and fifty officers of the medical department attended.

Dr. E. B. Fred, for thirty years a member of the department of agricultural bacteriology of the University of Wisconsin and for the past nine years dean of the Graduate School, has been appointed dean of the College of Agriculture.

Dr. John H. Ferguson, of the department of pharmacology of the School of Medicine of the University of Michigan, has been appointed professor and head of the department of physiology of the School of Medicine of the University of North Carolina. Dr. Ferguson is known for his research on the mechanism of blood clotting.

Dr. Robert J. Masters has been appointed professor and head of the department of ophthalmology at the School of Medicine of Indiana University. Dr. William F. Hughes, who since 1934 has been chairman of the department, will continue teaching.

Drs. Howard W. Potter, clinical professor of neurology and psychiatry, and Nicholas B. Dreyer, associate professor of pharmacology, have been promoted to full professorships at Long Island College of Medicine, Brooklyn.

Dr. Richard H. Logsdon, formerly librarian and head of the department of library science at Madison College, Harrisonburg, Va., has been appointed head of the department of library science at the University of Kentucky.

Dr. Lewis F. Steig, since 1936 librarian of Hamilton College, has been appointed assistant director of the Library School of the University of Illinois.

Colonel Bradley Dewey, of Cambridge, Mass., who was recently appointed acting rubber director of the War Production Board, has been named national rubber director. He succeeds William M. Jeffers.

Edward M. Collins, who has been on leave of absence for a year from Kent State University to teach at Williams College, has been appointed professor and head of the department of chemistry at Illinois College, Jacksonville.

Dr. E. J. Wellhausen, associate professor of agronomy in the department of agronomy and genetics of West Virginia University and associate geneticist of the Agricultural Experiment Station, has joined the staff of the Rockefeller Foundation in Mexico City.

Dr. Roberts A. Hearn, since 1936 director of industrial hygiene of the Kansas State Board of Health, has become medical director of the Indiana Division of the Republic Aviation Corporation.

William B. Murphy has been appointed deputy vice-chairman for production of the War Production Board. He will direct all production activities within the industry divisions and bureaus which report to the vice-chairman of the Office of Operations. Turner E. Currens has retired as chief of the Botanicals Unit of the Drugs and Cosmetics Section of the Chemical Division. He is succeeded by Henry W. Heinie. Garfield R. McDonald, of Cleveland, has been made assistant director of the Textile, Clothing and Leather Division.

Robert E. Allen has resigned as assistant deputy petroleum administrator of the Petroleum Administration for War, to become director of the Department of Information of the American Petroleum Institute, New York.

It is reported in *Chemical and Engineering News* that Harry A. Campbell, who for thirty-four years has been associated with the Bureau of Explosives, has been appointed chief inspector.

The *Journal* of the American Medical Association reports that the committee on the teaching of tropical medicine of the Association of American Medical Colleges has arranged that Dr. Donald B. McMullen, associate professor and head of the department of hygiene and public health and associate professor of bacteriology of the School of Medicine of the University of Oklahoma, should go to Central America during the month of September to observe methods of tropical disease control. He planned to spend about three weeks at a United Fruit Company hospital and at least a week with the local field unit of the Office of the Coordinator of Inter-American Affairs.

Dr. R. S. Campbell, since 1934 assistant chief of range research of the Forest Service, U. S. Department of Agriculture, will take charge of a new research project concerning problems of grazing on forest lands at the Southern Forest Experiment Station. These studies, to be conducted by the Forest Service in cooperation with the Louisiana Agricultural Experiment Station, were authorized by the Congress in the Agricultural Appropriation Act for the current fiscal year. The first step is to be a survey primarily of beef cattle grazing in the forests of Louisiana. Emphasis will be given to farms where livestock are grazed on forest lands as a major enterprise rather than incidentally. The survey is expected to bring out ways of coordinating forest grazing with the use of farm pasture and other feed and to indicate improved forest-grazing practices. The survey also will show the important problems of stockmen and other agencies so as to work out and apply improved management practices of forest grazing. It is believed that wartime production of meat, hides and wool can be increased considerably in Louisiana by better grazing management. There are sixteen million acres of forest land.

THE department of mechanical engineering of Bucknell University has been named "The George T. Ladd Department of Mechanical Engineering" in honor of George T. Ladd, a Pittsburgh industrialist who has been a trustee of the university for several years.

A LIBERTY ship launched at Baltimore on September 13 was named for Henry Lomb, of the Bausch and Lomb Optical Company, who with John Jacob Bausch established the company in 1853.

A SERIES of five lecture-demonstrations on the cause, prevention and cure of various diseases will be offered for teachers at the American Museum of Natural History on Friday evenings at 8 o'clock, beginning on October 2. The lectures will be given by specialists under the auspices of the New York Association of Biology Teachers. The program, together with the names of the lecturers, follows: October 2—"The Problem of Cancer," by Dr. Halsey Bagg. November 5—"The Problem of Syphilis," by Dr. William Bayard Long. December 3—"The Problem of Tuberculosis," by Dr. Grant Thorburn. March 3—"The Problem of Emotional Disturbances of Youth," by Dr. Marion Kenworthy. May 5—"The Problem of Certain Diseases of the Circulatory System," by Dr. William Goldring.

THE first Inter-American Congress of Radiology will be held in Buenos Aires from October 17 to 22, under the auspices of the Argentine Society of Radiology.

THE *Journal* of the American Medical Association states that competitive essays for the Warren Triennial Prize will be received until November 15. The prize was set up in a fund by the late Dr. J. Mason Warren in honor of his father, Dr. John C. Warren. The accumulated interest is awarded every three years to the best dissertation considered worthy of a premium on some subject in physiology, surgery or pathologic anatomy, the arbitrators being the general executive committee of the Massachusetts General Hospital.

THE daily press reports that thirty scholarships for study in Great Britain are being offered by the committee in charge of the British Boxer Indemnity Fund. Competitive examinations will be held on February 1, 1944, at Chungking, Sian, Chengtu, Kunming, Kweilin and Taiho. Scholarships will be for students in physics, mathematics, mechanical engineering, hydraulic engineering, aeronautical engineering, mining engineering, forestry, pharmacology, public health, economics, law, education and naval architecture.

The New York Times reports that an all-radio industry planning board was formed in New York City on September 16 to guide the efficient and orderly progress of radio and electronics after the war. Representatives of nine outstanding industries of the country announced that a tentative plan had been approved unanimously. These are the Institute of Radio Engineers, the American Institute of Electrical Engineers, the Radio Manufacturers Association, the American Institute of Physics, the American Radio Relay League, FM Broadcasters, Inc., the International Association of Chiefs of Police, the National Association of Broadcasters and National Independent Broadcasters. For the first time a supervisory body has been formed designed to avoid chaos in radio-electronic post-war reconstruction. Operations will begin on September 29, at which time various engineering groups will be set up to undertake definite projects. Any technical project allied with radio and broadcasting will come under the advisory supervision of the board.

The New York Times also reports that William L. Batt, vice-chairman of the War Production Board, American member of the Combined Raw Materials Board, has announced the organization of a combined conservation committee, the American counterpart of the Anglo-American Conservation Committee set up in London last February. The purpose of the combined committee is to correlate the conservation work done in Great Britain and the United States by the active interchange of information in regard to conservation measures developed here, in Canada and in the United Kingdom. Howard Coonley, director of the conservation division of the War Production Board, has been named chairman of the combined committee, and a deputy chairman is to be appointed by the British members of the Combined Production and Resources Board and the Combined Raw Materials

Board. The work of the committee will be concerned with savings through simplification, standardization and the use of alternative materials.

In accordance with a reorganization plan all dairy research will be centered at the New York State College of Agriculture at Ithaca, and the program at the Experiment Station at Geneva will be developed along the lines of horticultural research and related fields.

The Cutter Laboratories at Oakland, Calif., have arranged to erect a new plant for the production of penicillin.

According to the daily press, in order to assist in meeting the shortage of technical help in many of the war plants of the State of New Jersey, Rutgers University is sending instructors directly into factories to conduct in-service training classes. The courses are tuition free. Workers are saved the time which otherwise they would have to spend commuting between factory and school. This will not interfere with the operation of the university's public war-training centers where general instruction will be carried on in engineering, science and management. A similar plan is being put into effect by the Manhattan College School of Engineering, New York City.

The *Journal* of the American Medical Association reports that the Faculty of Medical Sciences of Buenos Aires recently opened its new building, occupying a whole block. It consists of twenty floors and will house the faculties of medicine, biochemistry, pharmacology, odontology, the Institute of Pathologic Anatomy, the Pardo Maternity Hospital and the Pavilion for tabetic patients.

DISCUSSION

TWENTY-FIVE-YEAR EFFORT AT SAVING NATURE FOR SCIENTIFIC PURPOSES

Nearly all interests excepting that of natural science are organized so as to exert pressure upon legislative and executive bodies when there are conflicting interests relative to land use. There are in North America, north of Mexico, more than five hundred local and national scientific biological organizations, most of which under ordinary circumstances are committed to saving of samples of biotic communities or samples of vegetation for the scientific use of present and future generations. It is evident that, if some kind of union of these interested forces could be brought about, a great many movements detrimental to the interests of science and humanity might be checked or retarded. Likewise movements beneficial to science could be accelerated through the influence of a united effort. The writer was appointed chairman of a committee in the Ecological Society of America in March, 1917, and served until 1938. This committee was charged with the listing of natural areas suitable for preservation. This proved to be the beginning of an effort to organize the scientific interests of the United States and Canada for the purpose of preserving nature. The list of natural areas, with related material, was published in 1925 as *The Naturalists' Guide to the Americas*. The closing out of the remaining copies of this publication by the publisher early in 1942 marked the twenty-fifth year of experience with the problems concerned.

An effective type of organization was brought about and has operated successfully for about sixteen years. Experience has shown that two types of committee are essential: (1) A Study Committee to inquire into the use and disposal of lands which included natural biotic communities, and (2) a Public Contact Committee to urge governmental agencies to act in certain ways. This one can include no employees of the national government. The second committee would be responsible not only for exerting pressure but also for organizing the pressure of the affiliated local societies and national organizations. Such an organized effort was successful in bringing about the establishment of the Glacier Bay National Monument in Alaska. In this case, application was made to the executive department of the United States Government and was said at the time to be one of the most unified demonstrations ever experienced by the officials concerned. There were other partially successful efforts to prevent the despoliation of national parks, monuments, etc.

The organization of the Public Contact Committee included two or more representatives in each political division (states, etc.) to provide an annual list of officers of local organization in their territory. The officers of the organizations changed and they frequently have not understood what they were expected to do and frequently lost interest. Of course the state representatives of the committee who were called upon to report did not always succeed in giving the information. These difficulties were the exceptions and were not at all prevalent. The expense of the committee operation has at all times been considerable and down to 1937, only 29 per cent. of it was paid by the society, even though some contributions of institutions where the committee officers were housed were not included in the total. A considerable part of the expense was provided by contributions of the interested societies who were a part of the organization.

A report, however, was sent to each contributing society showing what had been attempted and accomplished during the preceding year. The local and contributing societies were appreciative of such publications and reprints as could be supplied from time to time, but there was no regular publication, a fact which interfered with the payment of contributions for the work. In spite of difficulties, it has been demonstrated that it is clearly possible to make the local scientific bodies into an effective force. What appears to be needed is some means of keeping them in contact with the central committee.

In spite of the fact that the majority of members are interested, the Ecological Society of America has not yet developed sufficient interest to put this or any other plan on a permanent workable basis. At the end of the twenty-five-year period, the project is probably no better established than at the end of the first nine years, when the machinery was first put to work in the case of the Glacier Bay National Monument. With the wartime and post-war pressure to destroy nature already mounting, it is well for those interested in its preservation for scientific purposes to look over the machinery by which some of it may possibly be saved.

V. E. SHELFORD

UNIVERSITY OF ILLINOIS

ON METHODS OF "STARRING" AMERICAN MEN OF SCIENCE

THE recent discussions in SCIENCE regarding the practice of "starring" deserving men of American science seem to have missed the crux of the problem. The question of the usefulness or fairness of such a practice depends entirely upon the accuracy of the method by which the desired end is attained. If it gives predominating chances of selection to certain scientists with the exclusion of others equally worthy of consideration a serious injustice is done and the value of the practice of "starring" is correspondingly decreased. That the present method of "starring" affords a very unfavorable opportunity of selection for many deserving men can be very easily proved.

Forty-two research institutions are represented on a recent list of 82 chemists, nominated for inclusion among the 175 leading chemists of America, from which list 44 are to be selected for "starring" in the seventh edition of the Biographical Directory of American Men of Science. These institutions, with the number of nominees belonging to each, are indicated in the accompanying list.

Massachusetts Institute of Technology	8
Illinois	7
Wisconsin	5
Pa. State Col.	4
California	4
Columbia	4
Michigan	3
Northwestern	3
Chicago	3
Stanford	2
Minnesota	2
Princeton	2
Ohio State	2
Merck and Co.	2
Nat. Bur. Standards	2
Pennsylvania	2
Harvard	2
Pittsburgh	1
Purdue	1
Distill. Products	1
Eastman Kodak	1
U. S. Bur. Mines	1
Brooklyn Polytech.	1
Rockefeller Inst.	1
Cal. Inst. Tech.	1
Monsanto Chem. Co.	1
Conn. Agr. Expt. Sta.	1
Gen. Aniline Co.	1
U. S. Dept. Agr.	1
New Eng. Ind. Research Foundation	1
Shell Develop. Co.	1
Missouri	1
Rohm and Haas Co.	1
Bell Tel. Labs.	1
Ethyl Gas Corp.	1
Brown	1
Calco Chem. Co.	1
Cornell	1
Harvard Med.	1
Esso Labs.	1
U. S. Rubber Co.	1
Nebraska	1
	82

A few questions that every thoughtful recipient of this list might ask are: (1) What plan of nominations was adopted that gave Massachusetts Institute of Technology 8 times as many nominees for starring as the California Institute of Technology or any of the other 24 institutions having only 1 nominee? Is this proportion based upon number or productivity of research staff? (2) How does it happen that Yale, Johns Hopkins, Mellon Institute of Industrial Research and scores of other important chemical research institutions are not represented? (3) Has chemical research fallen so low in the institutions not mentioned on this list that they have no candidates worthy of being starred? Such a conclusion is too unreasonable to be considered. (4) Has general interest in the practice of starring men of science become so slight that many directors of research are indifferent about it and do not take the trouble to sponsor candidates? This is perhaps one explanation for the very unbalanced list of "starrable" chemists now being submitted.

Whether the situation as regards chemistry exists also in the lists of nominees for other sciences the writer has no means of knowing. If the same conditions prevail generally then the present system of selecting "stars" for inclusion in the Directory of American Men of Science is of little value and might just as well be discontinued.

There is nothing so fallible as human judgment and if the practice of starring men of science is to be continued it should be based upon purely impersonal methods of selection which are free from the faults of indifference, favoritism, etc., that give rise to unfair representation. Impersonal methods are in fact the only means of enabling a voter to make a selection from a long list of candidates of whom the majority are unknown to him. Among such impersonal criteria may be mentioned numbers of papers published in a given period of years, numbers of patents taken out, rank of position, offices held in scientific societies, honors awarded, etc. Each one of these methods has certain limitations, yet when considered together on a rating sheet the combined weighted average is as accurate as can be achieved by statistical methods of evaluation, and it is vastly superior to the result obtained by the common method of marking a long ballot upon the basis of personal acquaintance or of solicitation.

The author has compiled lists of selected chemists for his personal use from the decennial author indexes of *Chemical Abstracts.* If for this ten-year period a chemist shows a productivity, as author or coauthor, of over 20 papers, his name is added to a preliminary list to which other criteria are then applied. A preliminary list thus compiled includes deserving names that are not included on the list of chemists submitted by the editor of the new Directory of American Men of Science. It is open to the objection that an index of papers includes many items of trivial scientific importance, but it has its use as a rough rapid sorting-out method which can be combined with the results of other criteria, according to the purpose of the compilation.

Because of the frequency with which the Directory of American Men of Science is consulted and of the high regard in which it is held, it is most desirable that its method of "starring," in order to avoid the injustice of overlooking worthy candidates, be based upon impersonal methods of the highest attainable accuracy.

C. A. Browne

U. S. Department of Agriculture

CLAVACIN AND THE PRESS

Recently a press article appeared in many newspapers concerning the work done in this laboratory on clavacin, an antibiotic substance obtained by *Aspergillus clavatus.* The release given to the local press was so worded as to emphasize the fact that this material was being tested against *plant pathogenic bacteria,* and full credit was given Dr. S. A. Waksman, of the New Jersey Agricultural Experiment Station, and his associates for their discovery and pioneer work on clavacin. It was compared with penicillin, and the statement was made that clavacin was more bactericidal for *some species of bacteria* than was penicillin. Due to the wide publicity given penicillin, this statement attracted the attention of the outside press, and unfortunately resulted in decidedly misleading statements regarding the possibility of clavacin as a powerful new remedy for human diseases. Furthermore, some of the abbreviated articles made no mention of the previous work of Dr. Waksman and his associates.

The work done in this laboratory has been concerned primarily with the testing of clavacin-containing filtrates on bacterial plant pathogens. This research was undertaken as a result of the publication by Waksman, Horning and Spencer (Science, 96: 202–203, 1942) indicating that *Aspergillus clavatus* produced a bactericidal substance which was effective against both gram-positive and gram-negative organisms and, furthermore, its action was bactericidal as well as bacteriostatic. Since most species of bacteria causing plant diseases are gram-negative we reasoned that clavacin might be more useful in the control of plant pathogens than any of the many other mycogenous bactericides which had been described.

Dr. Waksman kindly furnished me a strain of *Aspergillus clavatus* which he had found to be very active in the production of the bactericidal substance. Using the media and the technic he suggested, we were able to obtain a material which gave similar results to those obtained by Dr. Waksman when tested against *Staphylococcus aureus,* the test organism used by most investigators. Using the unconcentrated, sterile filtrate, a series of tests were run against over twenty species of phytopathogenic bacteria. The detailed results and methods used will be published in full at a later date. In general, bacteriostatic action was observed in all cases at fairly low concentrations, while bactericidal action varied greatly. A comparison of *Staphylococcus aureus* with *Phytomonas pruni* indicated that the latter could be used as a standard organism for plant pathogens, since the lethal dose was about the same for these two organisms.

Comparisons of penicillin and clavacin were made on some of the plant pathogens, in each case using the unconcentrated filtrate from *Penicillium notatum* and *Aspergillus clavatus.* The *Penicillium notatum* culture was one known to produce a high yield of penicillin and the filtrate was standardized with *Staphylococcus aureus* as the test organism. The *Penicillium notatum* filtrate failed to show any decided bactericidal action against a number of the phytopathogenic species, whereas the Aspergillus filtrate showed its usual potency.

It is to be regretted that this comparison of clavacin and penicillin, when reported in the press, resulted in a flood of letters from people suffering from all kinds of diseases, whose hopes had been raised by the results obtained from penicillin and the wide publicity given this new "miracle drug." Dr. Waksman has stated that clavacin is quite toxic to animals and, certainly in its present form, is not likely to be a rival of penicillin or the sulfa drugs. It should be recalled, however, that penicillin was reported as "toxic" when injected into animal tissues before it was highly purified.

H. W. Anderson

Department of Horticulture,
University of Illinois

SCIENTIFIC BOOKS

BLOOD GROUPS AND TRANSFUSION

Blood Groups and Transfusion. By A. S. Wiener. Charles C Thomas. 1943.

This is the third edition of a book which has become the best known and most popular in its field. The author is one of the most eminent of present-day workers in blood grouping. While there are a good many persons in this country with wide experience in blood transfusion, and a number with intimate acquaintance with serological techniques as applied to blood grouping, Dr. Wiener is one of the few who is qualified to write as an authority on both fields, and the result is a book of unique usefulness. It is so written that it may be used immediately by those not previously acquainted with the subject, but it is at the same time quite complete, so that there will be few owners of it who will need to seek more complete treatises, of which in fact there are none which are at all up to date. Those sections which may be of interest only to specialists are given in small print and may be omitted by the beginner without loss of continuity. The reader who desires more detailed information will progress in nearly every case directly to the current periodical literature.

The last three years have witnessed a marked increase of interest in the fields of blood transfusion and blood grouping, owing not only to the outbreak of the war, but also to the widespread adoption of "blood banks" in civilian hospitals and to a much greater use of fresh and dried plasma and other blood substitutes. At the same time it is gradually coming to be realized in technical laboratories that blood grouping is not a casual affair to be entrusted to the untrained intern or technician, but a very important operation, upon the successful performance of which may depend the life of a patient. In addition, the increasing recognition that the subgroups, and in particular the blood factor known as Rh, may, and often do, play a role in transfusion incompatibilities, has made it essential that those who undertake to direct blood grouping be equipped with rather more specialized knowledge than is possessed by the average medical man. The role of Rh in erythroblastosis fetalis has also contributed to the change. Hundreds of new articles on these subjects have appeared since the second edition of this book, and Dr. Wiener has ably attempted to enlarge and bring the volume up to date.

The general intention of the book is to summarize the present knowledge concerning the theory and technique of blood grouping; to present the applications to clinical, legal and veterinary medicine, and in anthropology, and to assemble and integrate the essential facts concerning the transfusion of whole blood, plasma and serum. There are 22 chapters; two introductory chapters dealing with the general facts about the blood groups, one on sources of error in blood grouping, one on the history of transfusion, one on the selection of donors, three dealing with transfusion, a chapter on fundamental genetic principles and chapters on the heredity of the groups, subgroups and M, N types. The subgroups and other individual blood differences are discussed in separate chapters, as is the Rh factor. The occurrence of the group substances in organs and body fluids, the evolution of the blood groups, the relation to disease, all have their chapters, as do the forensic applications to disputed parentage and the grouping of blood stains. The applications to anthropology are also discussed in a separate chapter which contains considerable data in tabular form.

The book contains 438 pages, 132 more than the second edition. Part of the additional material is comprised in the two new chapters, one dealing with the transfusion of stored blood and blood substitutes and the other with the recently discovered Rh factor and its role in erythroblastosis fetalis. Most of the new material, however, is in the form of additions to original chapters, some of which have been almost completely rewritten. The chapters on transfusion have been improved by the inclusion of some new illustrations which are greatly superior to those of former editions. The anthropological chapter has been enlarged by the inclusion of new tabular data and illustrations showing certain salient features of the world distribution of the blood-grouping factors. Newer and more specialized techniques, such as the determination of blood groups from mummified material and from bones, are also discussed briefly.

The most useful features of the book are probably the clear expositions of the fundamental principles and the basis for division of blood into groups and subgroups and the descriptions of the technique of performing such tests, together with the very clear and detailed descriptions of transfusion technique and the indications for and results of transfusions. Particularly notable is the detailed discussion of the new Rh factor and methods of detecting it. Second only to these sections are the discussions of the heredity of the various groups and types and the application of this knowledge to forensic medicine and other fields. The discussion of individual blood differences in animals is also very good.

Possibly the least satisfactory chapter, in the opinion of the reviewer, is that on the anthropological applications. For, although the data presented in the tables are a good selection and are up to date, the discussion in the text is still too closely modeled on that of the first edition, which was written when many important facts were yet unknown and the significance of certain of the older data was still unappreciated. In particular there are several paragraphs, tables and graphs which might lead the unwary reader to suppose—falsely, I think—that Dr. Wiener holds the now abandoned theory that all American Indians, before white contact, possessed only blood group O. The data of Rahm, Golden, Matson and Schrader, and the calculations of Wyman and Boyd, which combined to render this theory untenable, are however referred to, and one may feel sure that the imperfection will be corrected in future editions.

The book is characterized by very complete references to the literature, in the form of footnotes to the text, as well as a bibliography of works of general reference. There is a very excellent subject index. Typography and format are of the same high quality as in previous editions, and the paper and binding appear to be excellent.

Wm. C. Boyd

Boston University School of Medicine

CHEMISTRY

Physical Chemistry. By Frank H. MacDougall. Revised edition. 709 pp. New York: The Macmillan Company. 1943. $4.25.

The good reception of the first edition (1936) of this text-book has led to the publication of its second edition (see preface). One who is familiar with the first edition will find the second almost unchanged, for "the author has not considered it necessary to make many substantial changes in the material discussed or in the manner of treatment." In particular, many will be glad to see that the large section devoted to chemical equilibrium has been retained without an alteration.

The principal revisions are the following: The table of natural isotopes has been brought up to date, the table of standard E.M.F.'s has been enlarged, three pages on liquid crystals and glasses have been added, the section on artificial radioactivity has been rewritten, one page on the glass electrode has been added, and the derivation of the Gibbs adsorption equation has been made more rigorous.

Several smaller improvements have been made. Equation II-(11) and Equation VII-(20), which contained errors in the first edition, have been corrected. Three problems have been added. The symbol E has been used instead of U for the energy of a system, so the text now follows the Lewis and Randall notation used by most American thermodynamics texts (including that of the author). The numerical values of the general physical constants have been brought more nearly up to date, though those given do not agree with Birge's latest (1941) values.

Since so few major revisions have been made in the text, several deserving topics have been given no more space in the second edition than they had in the first. For example, quantum mechanics has not been treated at any great length, while the theory of reaction rates has been omitted entirely. It is to be hoped that the author will devote additional space to some of these topics in future revisions.

It is disappointing to see that the old bombardment theory of osmotic pressure has been retained.

The decomposition of N_2O as an example of a second order reaction (p. 415 and Problem 7 on p. 446) should be abandoned, since experimental work more recent than that cited in the text has shown the reaction to be of 3/2 order (*cf.* Pease, "Equilibrium and Kinetics of Gas Reactions," Princeton University Press, 1942, pp. 129–134). In fact, a portion of the chapter on kinetics might well be devoted to 3/2 order reactions.

If the old equation of Bodenstein and Fink for the kinetics of oxidation of SO_2 on platinum is quoted, mention should also be made of the recent and much more satisfactory equation of Uyehara and Watson.[1]

These few omissions do not, of course, seriously impair the value of the book. The first edition was, and the revised edition remains, a well-written and useful text-book for beginning physical chemistry.

R. E. Powell

Princeton University

---

[1] *Ind. Eng. Chem.*, 35: 541, 1943.

SPECIAL ARTICLES

THE SEROLOGICAL ACTIVITY OF DENATURED ANTIBODIES[1, 2]

As a logical sequence to recent investigations on the effects of regeneration on the antigenic activity of serum albumin,[3,4] we have studied the influence of denaturation and regeneration on the immunolgical functions of antibodies.

The source of antibody was a concentrate of divalent types I and II antipneumococcus horse serum, obtained through the courtesy of the Lederle Laboratories, Inc. Over 80 per cent. specifically precipitable antibody of type I was isolated by successive precipitations with SSS I in the antibody excess region, and subsequent dissociation of the specific precipitate with 15 per cent. NaCl solution.[5,6] Guanidine hydrochloride, whose action on normal horse serum globulin, GI, has previously been studied,[7] was used as a denaturing agent.

---

[1] This work was supported by the Rockefeller Foundation and by the Lederle Laboratories, Inc.

[2] Taken from a thesis to be presented by J. O. Erickson to the Graduate School of Arts and Sciences of Duke University, in partial fulfilment of the requirements for the degree of doctor of philosophy.

[3] J. O. Erickson and H. Neurath, *Jour. Exp. Med.*, 78: 1, 1943.

[4] D. S. Martin, J. O. Erickson, F. W. Putnam and H. Neurath, *Jour. Gen. Physiol.*, 26: 533, 1943.

Irreversibly denatured and regenerated antibody were prepared by treatment of a 2 per cent. solution of the native antibody with 8 M guanidine hydrochloride, removal of the denaturing agent by dialysis and separation of the irreversibly denatured fraction by isoelectric precipitation.[7] The regenerated protein, remaining in the supernatant solution, was readily soluble in water and in physiological saline; the highly insoluble irreversibly denatured protein could be dissolved in 2 per cent. NaCNS in saline, to the extent of about 0.3 mg of protein N per ml, at pH 6.5.

After it was found that all fractions were specifically precipitable by the homologous antigen (SSS I), quantitative precipitin titrations were performed, using the method of Heidelberger and Kendall.[8] Comparison of the serological activity of native and regenerated antibody was made in physiological saline solutions, that of native and irreversibly denatured antibody in 0.9 per cent. solutions of NaCl containing also 2 per cent. NaCNS. Representative data relating to the equivalent combining ratios of mg antibody N to mg antigen, R, and to the per cent. of specifically precipitable antibody nitrogen, N, are given in Table 1.

TABLE 1

Preparation	Solvent	R	Per cent. antibody N specifically precipitable
Native antibody ..	0.9 per cent. NaCl	3.3	80
Native antibody ..	0.9 per cent. NaCl + 2 per cent. NaCNS	2.9	37
Irreversibly denatured antibody .	0.9 per cent. NaCl + 2 per cent. NaCNS	1.3	50–60
Regenerated antibody	0.9 per cent. NaCl	6.0	70

The data reveal no significant difference in the equivalent combining ratio of native antibody in saline and in the presence of NaCNS. When the supernatant of the specific precipitate, obtained at the equivalence point in the presence of NaCNS, was dialyzed against saline, no additional precipitation occurred unless more antigen was added, indicating that NaCNS had shifted the equilibrium between antigen and antibody rather than inhibited the precipitation of the antigen-antibody complex.

The difference in combining ratio between native, irreversibly denatured and regenerated antibody may be ascribed either to a change in effective antibody valence or else to changes in their molecular dimensions, as they have been found to occur when normal horse serum globulin GI is treated with concentrated solutions of guanidine hydrochloride. Molecular weight studies on these fractions are under way.

It is of considerable significance that the denatured and regenerated antibody were serologically active, and the general theoretical and practical aspects of this finding will be discussed elsewhere.

The fact that the regenerated antibody is nearly as fully precipitable by the homologous antigen (70 per cent.) as the native (80 per cent.), and the irreversibly denatured material even more so, when measured under comparable external conditions (50 to 60 per cent. as compared to 37 per cent.), suggests that, contrary to Pauling's hypothesis,[9] the difference between antibody globulin and normal globulin is not merely one of steric arrangement but probably one of amino acid composition. If denaturation of normal serum globulin, followed by regeneration in the presence of an antigen, should give rise to a fraction of a material possessing antibody activity,[10] then, conversely, regeneration of a denatured antibody in the absence of the specific antigen should, in keeping with that hypothesis, yield a material essentially devoid of serological activity. This, however, is not the case.

It remains to be seen whether the denatured and regenerated antibodies are effective in animal protection; requisite experiments are under way. Experiments on the relative antigenic activities of these fractions and on their antigenic relation to native and denatured normal serum globulins will be reported elsewhere.

John O. Erickson
Hans Neurath
Department of Biochemistry,
School of Medicine,
Duke University

PROTECTIVE EFFECT OF SEPARATE INOCULATION OF SPOTTED FEVER VIRUS AND IMMUNE SERUM BY INTRADERMAL ROUTE

The purpose of the present work is to investigate the possibility of protecting a susceptible animal against spotted fever by using minute doses of specific

---

[5] B. F. Chow and H. Wu, *Chinese Jour. of Physiol.*, 11: 161, 1937.

[6] M. Heidelberger and F. E. Kendall, *Jour. Exp. Med.*, 64: 161, 1936.

[7] H. Neurath, G. R. Cooper and J. O. Erickson, *Jour. Biol. Chem.*, 142: 265, 1941.

[8] M. Heidelberger and F. E. Kendall, *Jour. Exp. Med.*, 61: 559, 563, 1935.

[9] L. Pauling, *Jour. Am. Chem. Soc.*, 62: 2643, 1940.

[10] L. Pauling and D. H. Campbell, *Jour. Exp. Med.*, 76: 211, 1942.

rabbit hyper-immune serum. The immune serum was produced by repeated inoculations of rabbits with both spotted fever vaccine and the virus.[1] The intradermal route of inoculating guinea pigs with virus and serum was used.

Our study is based on the known phenomenon in which the infiltration of the skin in susceptible animals with specific immune serum affords protection against subsequent inoculation with the homologous virus of vaccinia.[2, 3, 4]

Three main factors were considered: the site of inoculation, the time factor and the amount of immune serum.

An area of ¼ square inch of guinea pigs' skin was infiltrated first with 0.4 cc of immune serum, and then two hours later 0.1 cc of virus was injected into this area. These animals remained afebrile and proved immune to subsequent reinfection with spotted fever.

Fifteen guinea pigs were then treated with 0.1 cc of virus and 0.4 cc immune serum simultaneously at the same site. No fever was noted in eleven of them, while four developed spotted fever. Only three of the non-reacting animals showed solid immunity to subsequent reinfection with spotted fever. Of six other guinea pigs injected with virus and serum as above but at *different sites* of the body, five developed typical spotted fever.

In the next series of thirteen guinea pigs smaller amounts of immune serum were used: 0.1 cc, 0.05 cc and 0.025 cc, the serum and 0.1 cc of virus given simultaneously and at the same site. Of these none developed spotted fever. Four weeks later they were all reinfected with a five-fold dose of virus and nine animals showed complete immunity in striking contrast with the control animals.

Inactivation of the virus in the skin was followed by solid immunity even when 0.025 cc of immune serum was injected at the same site and as long as 18 hours following the virus injection. Experiments are now under way to find out the lapse of time subsequent to virus inoculation after which immune serum will still protect the animal.

It is hard to believe that the negligible amount of 0.025 cc of immune serum could afford any degree of passive immunity. We may presume, however, that the virus absorbed by the highly potent anti-serum in the tissue acted as a sensitized vaccine. It is also possible that this amount of serum was not able to neutralize the virus completely, leaving a fraction of the virus to escape. Nevertheless, this negligible quantity of free virus would contribute to the protection of guinea pigs against the reinfection and thus confer a solid immunity. This interpretation clarifies the apparently puzzling phenomenon in which some of the guinea pigs treated with the same dose of virus (0.1 cc) but with larger amounts of immune serum (0.4 cc) did not develop immunity. Under these circumstances the virus was evidently rendered completely innocuous and the antigenic properties altered by the excess serum.

Whatever the intrinsic nature of these phenomena may be, they strengthen the emphasis laid originally by Besredka[5] on the role of the skin in infection and immunity. Due to certain autonomy of the skin as an organ it is possible by intradermal introduction of an attenuated pathogenic agent (bacterial or viral) to create a local immunity which is a step toward the production of a general immunity. In our work a local interception of the virus was achieved in various degrees by minute doses of specific anti-serum. Thus far the interception of the virus is still possible after 18 hours, but further experiments are in progress.

It will be of interest to determine whether it is possible to prevent the disease by the above method when the original tick virus is used.

LUDWIK ANIGSTEIN
MADERO N. BADER
GERALD YOUNG
DEPARTMENT OF PREVENTIVE MEDICINE AND
PUBLIC HEALTH, UNIVERSITY OF TEXAS,
MEDICAL BRANCH

SCIENTIFIC APPARATUS AND LABORATORY METHODS

OBSERVATIONS ON THE BIOLOGICAL VALUE OF A MIXTURE OF ESSENTIAL AMINO ACIDS[1]

IN a series of convincing experiments, Rose[2] established the conception, now generally accepted, that only nine amino acids are essential for the growth of the rat, but that a tenth, arginine, must be supplied to attain maximal growth. The technique employed by him consisted in eliminating amino acids one at a time from a dietary mixture containing both essential and non-essential amino acids. Impairment of growth occurred only when one or another of the ten "essential" acids was eliminated.

---

[1] N. H. Topping, *Publ. Health Rep.*, 55: 41, 1940.

[2] C. H. Andrewes, *Jour. Path. and Bact.*, 31: 671, 1928.

[3] R. W. Fairbrother, *Jour. Path. and Bact.*, 35: 35, 1932.

[4] R. H. Green and R. F. Parker, *Jour. of Immun.*, 45: 171, 1942.

[5] A. Besredka, "Études sur l'immunité," Paris, 1928.

[1] From the Department of Pediatrics, Johns Hopkins Hospital, Baltimore, Maryland. This investigation was aided by grants from the Rockefeller Foundation, Nutrition Foundation, Merck and Company and E. R. Squibb and Sons.

[2] W. C. Rose, *Physiol. Rev.*, 18: 109, 1938.

In addition to these classic studies, Rose stated in 1938[3] that animals whose only source of dietary nitrogen was a mixture of the ten essential amino acids "gained in weight just as rapidly as when all the protein components were supplied preformed." These latter experiments have never been published in detail. The question as to whether a mixture of essential amino acids provides an adequate substitute for dietary protein or complete protein hydrolysates has obvious practical implications. The recent study of Elman and Lischer[4] in dogs suffering from shock and that of Bauer and Berg[5] in mice have shown that a mixture containing only essential amino acids is distinctly inferior to a complete amino-acid mixture. In view of these results, it seemed desirable to us to carry out further experiments on rats in which the growth and nitrogen retention of animals whose sole source of N was an essential amino-acid mixture was compared with those of animals receiving complete amino-acid mixtures.

EXPERIMENTAL

Studies were carried out on young animals from a hybrid colony of albino and hooded Norwegian rats. Four diets were used which differed only in the composition of the nitrogenous moiety.[6] In diet "EAA," nitrogen was furnished as an essential amino-acid mixture[8] which differed, however, in some respects from that of Rose: the proportion of biologically "effective" amino acids used was that found in a typical animal protein—casein, and in addition a small amount of cystine was added. In diet "A," the nitrogenous moiety consisted of Amigen,[9] an enzymatic digest of casein in which approximately 15 per cent. of the nitrogen is derived from pancreatic protein. In diet "CTH," nitrogen was supplied as an acid hydrolysate of casein prepared in this laboratory which had been fortified with 1 per cent. cystine and 1.5 per cent. tryptophane, and in diet "C" it was supplied as unhydrolyzed casein. The food intake of animals on the "A," "CTH" and "C" diets was restricted to that of the animals on the essential amino-acid mixture.

RESULTS

The weight curves of animals on these different diets are shown in Fig. 1. The poorest performance was that of the animals on the "EAA" diet. These animals lost weight steadily and one of them succumbed during the second week. The general appearance of

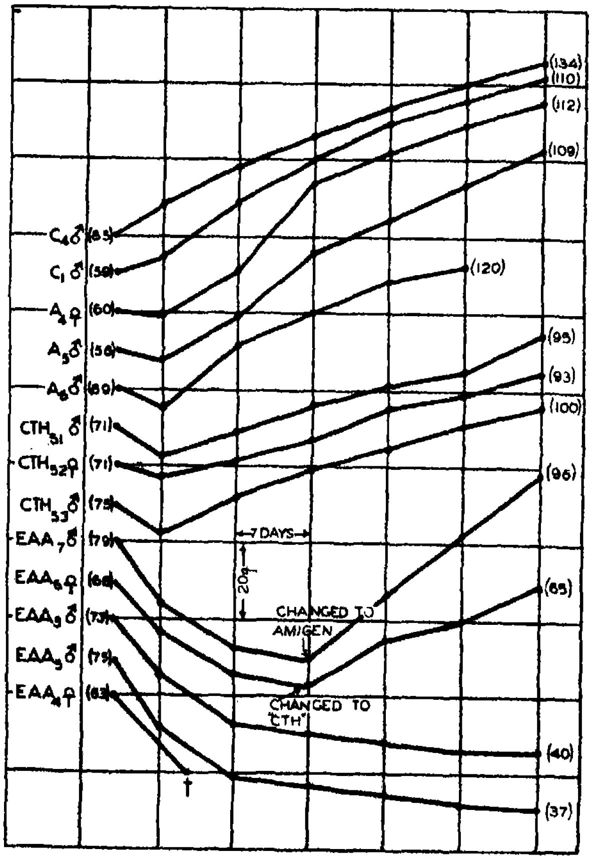


Fig. 1. Growth of rats on diets containing a crystalline amino acid mixture, reinforced acid hydrolyzed casein, Amigen and casein. The numbers in parentheses denote initial and final weights of the rats.

---

[3] Ref. 1, page 129.

[4] R. Elman and C. E. Lischer, *Jour. Am. Med. Asn.*, 121: 498, 1943.

[5] C. D. Bauer and C. P. Berg, *Jour. Nutr.*, 26: 51, 1943.

[6] The basal diet had the following composition:

Nitrogenous moiety	108.5 gms
(In the case of the essential amino-acid mixture, the quantity taken was 138.3 gms, allowance being made for the non-utilizability of the unnatural forms of certain amino acids added in the racemic form.)	
$NaHCO_3$	20.0 gms
Mineral mixture[7]	14.8 "
Sucrose	110.7 "
Starch	310.0 "
Agar	14.8 "
Cod liver oil	36.9 "
Crisco	140.0 "
Brewer's yeast	31.2 "

[7] W. M. Cox and M. Imboden, *Proc. Soc. Exp. Biol. and Med.*, 34: 443, 1936.

[8] Essential amino-acid mixture:

l-tryptophane	4.5 gms
l-lysine HCl	19.2 "
l-cystine	2.5 "
d-histidine HCl	6.8 "
d-arginine HCl	12.7 "
l-leucine	12.0 "
l-leucine—isoleucine mixture	14.0 "
dl-valine	32.0 "
dl-methionine	7.0 "
dl-phenylalanine	15.6 "
dl-threonine	12.0 "
	138.3 gms

[9] Kindly furnished by Mead Johnson and Company, Evansville, Ind.

these animals likewise was far from thriving. When a change was made to the Amigen ("A") diet or the fortified acid hydrolysate ("CTH") diet, gain in weight was promptly restored. The superior growth of animals on the Amigen diet as compared with the "CTH" diet may well be due to the pancreatic proteins present in Amigen, proteins which have recently been shown to have a high nutritive value.[10] The growth curves of animals on Amigen are comparable to those on casein with the exception of a slight lag when the animal is first put on Amigen.

Nitrogen balance studies were made on six additional animals which were fed the "EAA" diet. These studies were repeated after the diet had been changed to "CTH" diet. The data are shown in Table 1. It will be noted that although the diet on the "CTH" period was restricted to that taken on the "EAA" period, the animals gained weight during the "CTH" period in contrast to the loss of weight which occurred on the essential amino-acid diet. Despite the loss of weight on the "EAA" diet, the animals retained nitrogen, although the retention was noticeably less than that on the complete amino-acid diet. These experiments emphasize the fact that *in the growing animals* nitrogen retention can not be taken as a criterion of adequate nutrition.

TABLE 1

NITROGEN BALANCE OF RATS MAINTAINED ON THE AMINO ACID MIXTURE AND REINFORCED ACID HYDROLYZED CASEIN DIETS

Rat number and sex	Initial body weight	Amino acid mixture diet 4 × 3 day periods			CTH diet 4 × 3 day periods		
		Average daily food intake	Average N-balance per day	Weight change	Average daily food intake	Average N-balance per day	Weight change
	gms	*gms*	*mgms*	*gms*	*gms*	*mgms*	*gms*
EAA-10 ♂	60	4.2	+ 22.5	− 20	4.0	+ 31.1	+ 5
EAA-11 ♂	60	4.4	+ 29.7	− 17	4.0	+ 30.2	+ 4
EAA-12 ♂	60	4.1	+ 31.8	− 16	4.0	+ 42.0	+ 9
EAA-13 ♂	52	3.9	+ 29.2	− 15	4.0	+ 46.0	+ 8
EAA-14 ♂	61	3.45	+ 12.8	− 21	3.67	+ 36.0	+ 7
EAA-15 ♂	44	3.90	+ 19.8	− 10	3.92	+ 40.8	+ 7

Several possible explanations for the nutritive failure of the animals on the "EAA" diet suggest themselves. It is conceivable that the particular mixture employed contained too little of some one amino acid. In order to evaluate this possibility, a diet was prepared which contained essential amino acids in double the quantity used before (comprising 29.4 instead of 14.7 per cent. of the diet). Control experiments were carried out in which the nitrogenous moiety was supplied as "CTH" hydrolysate at twice the previous level. The food intake of the control animals was restricted to that of the "doubled EAA" group. The control animals on "double CTH" all survived, although their weight curves were flatter than those of the animals on 14.7 per cent. "CTH." On the other hand, the results on the high intake of essential amino acids were most unsatisfactory. Of six rats (54–60 gms) submitted to this diet, 3 ate well and died within 5 days, the other 3 ate the diet poorly and survived until sacrificed 3 weeks later. The weight loss in these animals was much more striking than in the 14.7 per cent. "EAA" animals.

It seems possible that the toxic effects of the high "EAA" diet as compared to the high "CTH" diet are brought about by the unnatural isomers of certain amino acids which can not be utilized by the animal. Bauer and Berg[5] attribute their unfavorable results with mice on a ten amino-acid diet to the "cost" of the additional synthetic work the organism is called on to perform—in energy and in building materials, undoubtedly factors of importance, but it is difficult to attribute the effects observed in our animals to other than a toxic cause. The possibility that one or more unutilizable optical forms of amino acids may exert a toxic influence is one that demands verification by direct experiment, and until it has been definitely excluded it would seem wise to employ only the natural forms in human therapy.

SUMMARY

(1) A mixture of "essential" amino acids, fed to rats, was found to be inferior from a nutritional point of view to enzymatic or acid casein hydrolysates or casein fed at comparable levels.

(2) Evidence is presented which suggests that the nutritive inadequacy of the essential amino-acid diet may be due in part to toxic effects of unnatural forms of certain amino acids that can not be utilized.

ANTHONY A. ALBANESE
VIRGINIA IRBY

BOOKS RECEIVED

Biographical Memoirs. Vol. XXII. National Academy of Sciences of the United States of America.
ANDREWS, ROY CHAPMAN. *Under a Lucky Star.* Pp. 300. The Viking Press. $3.00.
BARBOUR, THOMAS. *Naturalist at Large.* Illustrated. Pp. 314. Little Brown and Company. $3.50.
SHARP, LESTER W. *Fundamentals of Cytology.* Illustrated. Pp. x + 270. McGraw-Hill Book Company. $3.00.
SMALL, SIDNEY AYLMER and CHARLES RAMSEY CLARKE. *Simplified Physics.* Illustrated. Pp. ix + 428. E. P. Dutton and Co. $3.00.
STRONG, EVERETT M. *Electrical Engineering Basic Analysis.* Illustrated. Pp. xii + 391. John Wiley and Sons. $4.00.
TURRENTINE, J. W. *Potash in North America.* Illustrated. Pp. 186. Reinhold Publishing Corporation. $3.50.

---

[10] A. White and M. A. Sayers, *Proc. Soc. Exp. Biol. and Med.*, 51: 270, 1942.

SCIENCE

Vol. 98 FRIDAY, OCTOBER 1, 1943 No. 2544

Warfare and Natural Resources: PROFESSOR HENRY BALDWIN WARD ... 289

The North American Ragweeds and Their Occurrence in Other Parts of the World: H. A. ALLARD ... 292

Obituary:

James McGiffert: PROFESSOR H. S. VAN KLOOSTER. *Recent Deaths* ... 294

Scientific Events:

Visit to the U.S.S.R. of British Surgeons; Restoration of the Museum of the Royal College of Surgeons; Rare Chemicals; The Headquarters Building of the American Institute of Physics ... 295

Scientific Notes and News ... 297

Discussion:

Geologists in War Service: PROFESSOR KIRK BRYAN. *Apparent Time Acceleration with Age:* DR. PETER T. DONDLINGER; FRANK WILEN; PROFESSOR W. D. ENNIS. *Further Note on Russian Names:* DR. K. STARR CHESTER. *The Diet of Chinese Soldiers and College Students in Wartime:* T. SHEN ... 300

Quotations:

Science and Industry ... 303

Scientific Books:

Sir J. J. Thomson: DR. W. F. G. SWANN. *Organic Chemistry:* PROFESSOR MARSTON T. BOGERT 304

Societies and Meetings:

The Virginia Academy of Science: DR. E. C. L. MILLER ... 306

Special Articles:

Isolation and Characterization of Influenza Virus B (Lee Strain): DR. JOSEPH W. BEARD and OTHERS. *The Ether Soluble Fraction of Navy Beans and the Digestion of Starch:* DR. DONALD E. BOWMAN ... 307

Scientific Apparatus and Laboratory Methods:

The Protective Action of Glucose in Bovine Plasma against Heat Coagulation: PROFESSOR CHESTER R. HARDT, DR. I. FOREST HUDDLESON and PROFESSOR CHARLES D. BALL ... 309

Science News ... 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

WARFARE AND NATURAL RESOURCES[1]

By Professor HENRY BALDWIN WARD

UNIVERSITY OF ILLINOIS

THE current literature of the day is replete with vivid pictures of the tremendous struggle in which our nation is involved. Our magnificent isolation between two great oceans has vanished like a dream of the night. What our school books have called a continent is after all only an island, nearer to Europe and Asia than England was to Napoleon.

We are forced to ask ourselves, What of the future? Can we meet the demands of a new era or must we face the realization of the historian's vision that saw the decline of western lands and the passing of power to new nations?

As nation after nation fell into the hands of the plotter, we waited and watched with fatuous confidence that such things could not happen here. Rudely awakened from our dream we are bewildered by vast and urgent demands of a war front that girdles the globe and involves all nations. Confusion is the order of the day. The conflict allows of no compromise, and we are committed to the defense of our freedoms. We must win the war. Every activity, every interest must be subjected to the acid test that will decide its relations to our purposes.

Among the topics which have loomed large in public discussion, no one has demanded in recent years more general attention than that of our natural resources. What then could be more appropriate for the annual conference of the Texas Academy of Science than your program with its discussion of the relations of natural resources to war, the foremost obligation of this nation to-day.

---

[1] Invitation lecture at the annual meeting of the Texas Academy of Science, November 13, 1942.

The concept of natural resources has often been far too narrowly interpreted. Writers list a few things in the environment which man uses profitably and have been content to rest the case there. The nomads who ranged over these plains of Texas before the white man came might have listed its resources—if they ever cherished such a concept—as fish, food and furs. From these resources they could eke out a precarious existence and develop a simple culture for a scanty population. From those same lands the Texans of to-day have built up wealth, are supporting in comfort a large and growing population, and have a highly developed culture that is founded on resources of which the red man had no intimation. Not only that. From the record of the past fifty years, one may predict with reasonable certainty that in another half century the state will support a much larger population, with greater comfort, security and happiness than it does to-day. The student of science sees definitely that advances in the past open the way to greater achievements in the future.

Natural resources really include all the many and varied types of things found in the world about us, the living and non-living materials that nature furnishes in the vast and little understood complex we call environment. Even imperfect acquaintance with the North American continent compels one to acknowledge that it is remarkably well supplied with natural resources. Few items are entirely lacking, and most of those regarded as of vital importance are present in large amounts.

The amount of non-living resources is definitely limited. When the supply fails substitutes alone can relieve the need. No such limitation affects the supply of biological resources. The power of reproduction present in living things makes it possible under proper conditions to produce a new supply and thereby make good the inroads of the past. This power of life is immensely valuable, for it affords the only chance for future increase in the amount of resources available. At the same time it is also dangerous. Living things are easily destroyed and once a particular type has been exterminated, it can not be restored. Furthermore, when the supply of a given type of life has been reduced to low terms, the process of recovery is slow at best and to restore the type may prove impossible.

In considering the effects of war on biological resources their characteristics are all of serious import. In nature such resources are favorably or unfavorably affected by changes in the environment and as the result types of animal or plant life are held in balance, become dominant or are wiped out. Natural recovery is slow. When man enters the picture, losses are speeded up. Modern man has been called the great destroyer and in the present machine age effects marvelous changes in brief time.

Men talk in various ways about values and basic resources; but after all there is only one measure of value. Life alone counts. Without life, a world of air, water, soil, metals, fuel and all else would be meaningless to us. Natural resources acquire value only because of life and in the present world for man primarily and ultimately.[2] Conservation must be defined in terms of *human use* and that is in values for present and future needs of man. Too often in the past we have put our eyes to a microscope and focused that on the details of a tree. We have been so absorbed in such details and their analysis that we have never once thought of the forest as a living thing.

The world about us is a unit, its parts bound together by life in an all-embracing complex and so intimately related that interference at any point effects changes often unpredicted in extent and character. By the discovery of new natural resources man advantages himself and his age. He has also been able to devise more effective methods and even to create new substances. Ultimate success in the handling of natural resources demands vision as well as ability and energy.

FATE OF RESOURCES IN WAR

The general effect of war on the natural resources of the regions and nations involved is unmistakably clear. War is a carnival of waste. The impoverishment of ancient fertile soils in Northern Africa by prolonged warfare has created the desert of to-day in which a scanty population of destitute nomads ekes out a hand-to-mouth existence. War started the process of destruction and ignorance and carelessness promoted it. Destruction of water control systems by violence, loss of fertile soils by consequent erosion, laying waste of forests, farms and cities by continued strife completed the general ruin of a once beautiful and resourceful region. History is full of such records. Conservation even in wartimes is an absolute essential.

During wars the destruction of natural resources is redoubled. Protective measures are neglected and constructive work is abandoned. Even the victor in the struggle is heavily penalized, for warfare is in fact doubly destructive. Each contestant strives to reach and destroy the most and best in the resources of his opponent, while at the same time he is expending without stint his own possessions. These expenses have grown apace as man's capacity to construct and operate machines has developed.

The fighting forces must be provided with food and equipment no matter how the rest of the population fares. This is the correct policy; we all agree for we must win. But how tremendous the drain on the nation's resources. Even nations which firmly resolve to keep aloof from war and remain at peace may suffer none the less heavily, as witness the fate of Norway and Holland to-day.

---

[2] This point of view has been more fully set forth in my recent book on "The Foundations of Conservation Education."

CONDITIONS IN THE UNITED STATES

The general conditions just outlined represent in varying degree the experiences of all nations but especially those which in the Old World have been entangled in strife for centuries. It was from those peoples that men and women sought the freedom of the New World. They saw in the rich virgin territory and in the lands across great oceans relief from the ever impending destruction of lands and crops as well as homes and lives. This is our first national experience in a struggle which calls for total devotion of ourselves and all we have to the defence of our freedom. As we survey the past record of this land and its resources what do we see?

The bold adventurers who first landed on the eastern shores found dreams of wealth and ease fade fast as they fought long and hard for a victory that at times seemed none too certain. At every forward step in the conquest of the continent the pioneers paid a heavy price for their advances. Nor did they know much of the abundant resources existing in lands over which they won control. It was left for later generations to dig the mines, exploit farms and forests, harness the waters and reap rich harvests in the domain that the pioneers had bequeathed to them. For two hundred years the pioneers toiled and pinched and saved. Those who came after them have talked and promoted and wasted.

In the last century the record of our nation in handling its natural resources is a sorrowful tale. Too many of us have been content to live an easy life, ever seeking new ways to find wealth and scatter it on pleasure with little thought of the nation and its future.

No continent is so richly supplied with all natural resources that it can meet every demand that may be made upon it. Confronted to-day by extraordinary demands for war purposes, we are startled to learn that the supply of certain resources is no longer "unlimited," as had often been asserted in the past. Science is at once called upon to solve the problem.

Substitutes may be found or new methods achieve the desired result. In all such work the immense mass of detail piled up by the research of past workers is invaluable. So the nation has called into service the best talent of university and technical laboratories and sets it to work on the problems of war. New methods and new products increase the supply of natural resources and the variety of functions which they can serve. From the partial reports which have reached the public ear it is already evident that the study of war problems has yielded discoveries and inventions of great value for human life.

New processes of diverse character use wood to replace metals. At the other extreme wood products are woven into garments for winter clothing or of the delicate character of my lady's sheerest stockings. The waste of paper and pulp mills becomes basic material for making rubber. In the hands of the scientific experimenter glass is spun into fibers for the daintiest of gowns; it becomes the lightest of foams in the life-saving suit of a shipwrecked sailor or in other form serve him as a bullet-proof shield.

The pressure of wartime demands has yielded countless such extraordinary products. Under conditions of peace all of them might have been produced sometime but surely in no such brief period. Warfare is terribly destructive of natural resources but it also raises the tempo of new production. Life after the war has ended will follow new lines: it will not be anything like that in the days before the war. The nations of the earth are paying a ghastly price for these reforms. But more than ever before the return will be larger because science has been put to work.

Warfare like other periods of social disturbance affords favorable opportunities for looting the public treasury. But the endowment of the nation includes other resources even more valuable than its cash. And careful attention has not been paid to the expropriation of natural resources. Careful students have estimated that more than one half of the natural resources that the continent originally possessed has disappeared within the first two hundred and fifty years of our history.

One conspicuous example, a bad habit characteristic of our country and serious even under peace conditions, becomes even more threatening in wartimes. I refer to the pollution of lakes and streams by municipal and industrial wastes. The practise has grown with increase in population and industrial plants until it threatens not only the welfare and health of our people but even their very existence. No other civilized nation in the world gives such license to these practises as we have. Public opinion here has been indifferent probably because of ignorance and failure to recognize the problem in its true light.

In World War I stream pollution flared up suddenly like an epidemic and spread like the plague. Whole rivers were loaded with poisonous chemicals such as the waste products from ammunition plants, and the streams became foul and lifeless. Such conditions are not "inevitable," as some have said. Since the practise has been condoned for more than a century and despite the protests of conservationists tolerated during easy times of peace, it is too much to hope that it can be corrected in the strenuous days of wartime. Yet despite all excuses that are offered for the practise, pollution is *waste*. And the country will in some future day pay for to-day's bad habits and thoughtless waste.

WHAT OF THE FUTURE?

The greatest problem of the future we face to-day is not merely the winning of the war but the condition of the world at its close. The exhaustion of natural resources has proceeded at a stupendous rate. Nations have been drained of men, money and materials.

The fate of the natural resources, usually unmentioned if not unnoticed, has a profound bearing on the future of a people and on possibilities of postwar reconstruction. History furnishes many records of change in areas where once fertile lands, famous forests and abundant water supplies were the firm foundation of prosperous and highly developed national cultures. But the armies of conquerors scourged the people and laid waste the cities. It was not the slaughter of peoples that worked the final destruction, for remnants of defeated nations or new groups have at times wandered in and built new cities on the ruins of the old. Excavations on the site of ancient Troy have demonstrated that eight cities in succession were wiped out by ravaging hordes and rebuilt later on the ruins of the past.

Earlier warfare concerned itself little with the land and its natural resources, but as time went on destruction became more widespread and intimate. To-day totalitarian warfare not only destroys life and scatters the remnant of the people but makes levies on natural resources that provide for their exhaustion. The pace of destruction in Europe has already gone to an extreme which in the past has meant abject poverty for the postwar population.

In the present war the destruction in our own country is enormous, disastrous, but not annihilating. Wisdom commands not only maximum effort and devotion to promotion of the war but also obedience to the fundamental principles of conservation. To stop work inaugurated for the protection of our natural resources, to abandon well-planned measures for their conservation will open the way to unnecessary loss at the present time and leave us at the close of the conflict without organized means of guarding whatever of these resources is left for the future. The sacrifice of plans and trained leadership is both unnecessary and unwise. The foundation of conservation is biology; the bulwark of the cause is education. On teachers of biology rests the responsibility of rebuilding their courses to fit the needs of a new era. Dry-as-dust details must be eliminated; more of life, its relations, its meaning and its needs must be introduced. Courses overburdened with technical details will never train general students to be good citizens, to understand values, to fight fads or to detect political or commercial deceit. The success and permanent progress of our country must rest on well-trained and well-balanced public opinion. That can only come through the scientific attitude and good teaching.

THE NORTH AMERICAN RAGWEEDS AND THEIR OCCURRENCE IN OTHER PARTS OF THE WORLD

By H. A. ALLARD
BUREAU OF PLANT INDUSTRY, WASHINGTON, D. C.

THE pollens of the ragweeds (Ambrosia) are responsible for most of the so-called autumnal "hay-fever" discomforts which allergic persons in the United States experience during August and September. In the East, the giant ragweed, *Ambrosia trifida* L., and the low ragweed, *A. artemisiifolia* L., are the two species mainly responsible for these allergic troubles. Both were originally native to North America.

The flowering period of these ragweeds extends from early August into October, and farther south may even begin in late July in some instances. The author's studies, bearing on the relation of flowering to length of day, have shown that the flowering time of these plants, as in the case of many others, depends upon particular lengths of day. After the summer days have shortened sufficiently, the flower primordia are laid down, and the continued decrease in length of day as summer progresses causes anthesis of the staminate and pistillate flowers which, in the monoecious ragweeds, are borne on the same plant. In brief, these ragweeds withhold flowering until the days have shortened to their requirements, and they have been termed short-day plants for that reason.

Length of day appears to be one of the most important factors of climate concerned with the final stature and latitudinal distribution of these plants.

In latitudes where very long days prevail around the summer solstice favoring a long pre-reproductive vegetative phase of development before flowering is initiated, the plants merely increase their stature with leafy branches. When the days have finally reached the critical length for flower formation, these plants, as a result of their large size, are enabled to produce enormous quantities of pollen.

In higher latitudes, however, due to lower mean temperatures and a shorter frost-free season, a point is reached where the ragweeds can no longer fruit successfully before frost. This failure to produce seed establishes definite limits of range wherever the plants grow, whether in the region of their native home or in other cold temperate regions where they are aliens.

It is interesting to note that the ragweeds have a very sparse and precarious distribution north of latitude 50°. In North America the giant and the low ragweeds scarcely reach the Gulf of St. Lawrence, and they are not listed and apparently do not occur in the Alaskan area, most of which lies north of 55° to 60°.

These weeds have been unintentionally introduced into the British Isles and Europe many times, but they have not successfully established themselves in the British Isles, Scandinavia, Belgium, Holland and most of Germany, all of which countries lie mostly or entirely north of the parallel 50°. The principal regional and local floras of these countries either fail to mention these plants altogether or record them as mere casuals, appearing one season but failing to persist. R. L. Praeger lists no ragweeds in his flora ("Irish Topographic Botany," 1901) of Ireland, which lies between the latitudes 51° and 55° 23′ north.

In middle latitudes lying near 32° to 35°, these ragweeds appear to naturalize readily, for they are abundant in Madeira and also in Bermuda, both island groups lying near 32° north. Conditions do not appear to be especially favorable for the ragweeds in Portugal, Spain, Italy or even in France, for the more important floras either do not list them at all or report them as merely local or casual species. In Portugal and in Spain they are considered very unimportant components of the flora.

In North America, the most favorable length of day for the maximum reproduction of these plants appears to lie roughly between 45° and 30° to 35°, and these limits should also apply throughout Europe and Asia, and in similarly situated land areas in the southern hemisphere, provided such other conditions as soil moisture and temperature are also favorable.

It is now of considerable additional interest to learn the status of the ragweeds in subtropical or equatorial areas in so far as local and regional floras have revealed their occurrence here. The ragweeds do not appear to exist, or are of extremely rare occurrence, in all parts of India, Burma, the Malay Peninsula, Indo-China, China proper, the Philippines, Egypt, in North Africa and in the tropical and sub-tropical islands of the Pacific. In Australia they have been reported only from the extreme southern portion, below latitude 30° south. Low ragweed has been reported as an alien in Japan, but the locality was not given and it may be only sporadically naturalized. However, the principal islands covered by the Japanese empire lie mostly between the latitudes 32° and 45° north. On a length-of-day basis these should afford a highly favorable region for the successful naturalization of our common American ragweeds, which flourish between these latitudes in North America. There is every reason to believe that the ragweeds are of little or no importance in the flora of Oceania, comprising the islands lying between the two parallels 20° south and 20° north. Otto Degener mentions no ambrosia in his flora of the Hawaiian Islands ("Flora Hawaiiensis," 1940), these islands lying between the latitude 18° 54′ and 22° 15′ north. They do not appear to occur in New Zealand, near 40° south.

Since the American ragweeds reach northern Mexico but seem to disappear southward, and they are not reported in any of the better known Central American floras, it is indicated that these plants as they occur in the United States can not adapt themselves to tropical or equatorial conditions. Whereas the days were too long in far northern latitudes, there is reason to believe that failure to naturalize in the warm tropics is due to lengths of day that are now too short. This phase of ragweed behavior will not be discussed here, however.

On the basis of the known distribution of ragweed, its very definite autumnal flowering in response to a shortening length of day in extra-tropical latitudes, and its seeming absence in tropical regions, certain conclusions may be drawn.

In Alaska allergics will experience no trouble with ragweed pollens. In Europe north of 50° they will find little, if any, inconvenience from any of the ragweeds. In southern Europe, more especially in the warmer coastal sections and along the warmer river valleys of southern France and Italy, the ragweeds may be expected to occur, but even here they do not appear to occur with the same widespread abundance and persistence that characterize them in American fields and waste places. In practically all parts of India, China, Burma, Indo-China, the Malay States and Egypt, so far as any published lists reveal, they will find no ragweeds to bother them.

In subtropical and equatorial regions allergics should have no trouble with the temperate region ragweeds, and even the tropical species appear to be sparsely represented.

They should not be subjected to ragweed pollens in Oceania between the latitudes 20° N. and 20° S. This zone includes practically all the large islands of the Pacific area between Japan and Australia where fighting has been in progress since our entry into the war.

South of the equator, in southern temperate latitudes, the ragweeds appear to show a distribution in response to length of day and other factors similar to that of the north temperate zone. The flowering season, however, is now related to the south temperate summer and fall season, which occurs from December to March and April.

Even in European regions where ragweed might occur as a casual, it will be limited to very low altitudes, owing to its requirements for particular conditions of seasonal warmth. In eastern North America, and in these middle latitudes where the seasonal length of day favors its optimum success as a vigorous and abundant weed, the plant disappears near altitudes of 3,200 feet, as in the Cabin Mountains of West Virginia. It is small and a rather localized component of the flora at Davis, West Virginia, at an elevation of 3,100 feet. Temperature alone operates at these altitudes, since the summer mean temperatures are very low, the season of growth between spring and autumn frosts short, and unfavorably low temperatures are likely to occur at any time during the growing season.

While it is recognized that allergic persons are affected by the pollens of particular groups of related plants in a family, rather than by a single species, because their pollens appear to have certain irritant principles in common, the ragweeds must still be considered major offenders wherever they occur abundantly. This is recognized in the United States and in the temperate regions of South America, more especially in parts of Argentina where certain species are very abundant, and where two to three per cent. of the population is allergic from one cause or another.

From this survey of the occurrence of the ragweeds (Ambrosia), in temperate and tropical latitudes, as revealed by the principal floras of the world, it seems safe to conclude that American soldiers campaigning in most of Europe, in the tropical regions of Asia, Africa and the warm tropical islands of Oceania, lying between 20° N. and 20° S., will have little to fear from troublesome ragweed pollens, even though they may have been allergic to such in America.

OBITUARY

JAMES McGIFFERT

1868–1943

ON June 18 James McGiffert passed away at Los Angeles, a few hours after he arrived at his residence in California where he used to spend his summer vacation for many years.

Of Scotch-Irish descent McGiffert was born at Stockport, Columbia County, N. Y., and received his early training in nearby Hudson. Entering Rensselaer Polytechnic Institute in 1887 he graduated in 1891 with the degree of civil engineer. After one year of postgraduate work in mathematics at Johns Hopkins he returned to his alma mater as assistant in mathematics. Three years later he entered Harvard University, where he took the degrees of A.B. and A.M. simultaneously in 1896. Resuming his career in Troy he became assistant professor in 1900, associate professor in 1920 and in 1932 full professor in charge of graduate courses and consultant to the department of mathematics. In his early years as a teacher he published, mainly for the use of his own students, "Notes on Algebra," "Problems on Mensuration" and "Mathematical Shortcuts." His growing blindness, which deprived him of his sight completely when he was fifty, did not diminish his efforts to keep up with the times. In June, 1927, when he was approaching his sixties, Columbia University awarded him the doctorate in philosophy and in the next year McGiffert published his "Plane and Solid Analytical Geometry." Shortly before his death he wrote a brief introduction to algebra and geometry for use in defense courses. An active member of the American Mathematical Society and for years on the board of editors of the *Mathematical Magazine* he frequently lectured on mathematical and allied topics.

A staunch Presbyterian and devout churchman, he conducted for many years a class for students whom he impressed as much with his knowledge of the Bible as with his wizardry in mathematics. Outside his own field he was particularly interested in language and languages (was it not Gibbs who stated that mathematics was also a language?). A purist in the matter of language, who knew and appreciated the origin and the meaning of words, McGiffert for twenty-eight years presided over and guided the destinies of the Troy Society for Spoken English, where he acquainted his fellow-Trojans with leaders of science, literature and the pulpit.

No account of his life work could be complete without mentioning Cora Emily Medway, whom he first met in his Harvard days and married shortly afterwards. Without his "Coralie," an accomplished musician, a marvelous housewife, a never-tiring reader and (by courtesy) an assistant-mathematician, his life could never have been so complete. His superb courage and cheerful optimism in the face of adversities, among which his blindness was the most perplexing, were astonishing. What he might have accomplished without this affliction, nobody can tell. As it was, his married life was singularly happy and full, he had a host of friends, few if any were his enemies, and his epitaph may well be summarized in three simple words —loving, lovable, loved.

H. S. VAN KLOOSTER

RECENT DEATHS

DR. HENRY GRAY BARBOUR, professor of pharmacology and toxicology in the School of Medicine of Yale University, died on September 23 at the age of fifty-seven years.

THE death at the age of sixty-nine years is announced of Dr. Umetaro Suzuki, known for his work on vitamins. Dr. Suzuki was president of the Scientific Research Institute of Manchukuo and professor emeritus of Tokio Imperial University.

SCIENTIFIC EVENTS

VISIT TO THE U.S.S.R. OF BRITISH SURGEONS

IT is reported in the *British Medical Journal* that the four British surgeons who had been paying a three-weeks visit to Soviet Russia attended a reception given in their honor by the British Council immediately upon their return, and gave the assembled company some account of their experiences. This British mission was sponsored jointly by the British Council and the Medical Research Council, and its members were Surgeon Rear-Admiral G. Gordon-Taylor, consulting surgeon to the Royal Navy; E. Rock Carling, consultant adviser to the Ministry of Health, the Ministry of Home Security and the Ministry of Pensions; Major-General D. C. Monro, consulting surgeon to the British Army (War Office); and R. W. Watson-Jones, civilian consultant in orthopedic surgery to the Royal Air Force. Two American surgeons, Lieutenant-Colonel Elliott and Lieutenant-Colonel Loyal Davis, and a Canadian surgeon, Professor Wilder Penfield, accompanied them.

The visitors during their short stay in Russia inspected hospital arrangements as far forward as Vyazma on the Western front, visited the clearing field and mobile hospitals, and inspected the medical institutes and depots in Moscow. They found the organization of Russian medical services excellent. In their surgical work the Soviet medical service, with some differences in detail, follows the same general principles as those accepted in British war surgery, and has reached the same conclusions. The commissar in charge of the service stated that at the time of the last war the Russians realised that their arrangements were not as good as those of their allies, and during the twenty-five years between the two wars they have set themselves to reach a standard of medical and surgical work which will bear comparison with that of any other belligerent country.

Two points impressed the mission very greatly. One was the system of blood transfusion, which is carried out on a colossal scale. The arrangements for the collection of blood are beyond criticism, and the number of voluntary donors is very large. In one institution in Moscow a daily average of 500 to 800 donors are bled, and 90 per cent. of them are women. No woman is allowed to be bled more than seven times a year, but in practice, so large is the number of volunteers, they are not bled more than five times. They receive extra rations and also payment, but four fifths of the money received is returned for war purposes. The same procedure is followed as in this country in the use of plasma and serum. In no circumstances has the Russian Army lacked transfusion blood.

As for the medical personnel, the chief of the medical services of the Russian Army, General Smirnov, is thirty-five years of age, and an expert opinion on him given by an academician was that he not only was an admirable administrator but was held in the highest regard by his colleagues from the professional point of view. The medical service is becoming a woman's service; 90 per cent. of the doctors now under training are women, as compared with 50 per cent. in peacetime. For doctors in Russia the ordinary course before the first state qualification is five years, which is comparable with the British requirement. It takes three years to get a bachelorship and three more years to get a doctor's degree. Nurses had three years' training before the war, and this is now reduced to two years.

The Russian nurse evoked the great admiration of the visitors. Not only is she excellent at the job for which she has been trained, but she can turn her hands in spare time to any employment, even to building hospitals, involving cutting down trees, squaring timber, making window and door frames, digging out foundations. She is specially expert in the art of camouflage.

The visitors made as extensive an inspection as was possible during their brief stay. They saw something of the research institutes and medical organization in Moscow, where the civil defence and ambulance arrangements impressed them. Five telephone operators are detailed every night to deal with emergency medical or surgical calls from any part of the city, and within two minutes of the receipt of the call a well-equipped ambulance, with doctor, nurse and orderly, is on its way.

RESTORATION OF THE MUSEUM OF THE ROYAL COLLEGE OF SURGEONS[1]

The wrecking of the greatest pathologic and anatomic museum in the world—that of the Royal College of Surgeons—by German bombs has been described previously (The *Journal,* July 8, 1941, p. 58; February 28, 1942, p. 747). Nearly two thirds of the specimens were destroyed, including much that was irreplaceable, such as the Hunterian collection. Within a few weeks the council of the college set up a committee under the chairmanship of Professor Grey Turner to plan a new museum based on the surviving specimens and the traditions of the old but adapted to present conditions, which differ vastly from those of a hundred and fifty years ago when the museum was founded by the government's purchase of John Hunter's great collection. The museum was then the only one of the kind, but now every medical school has formed its museum. The museum will be devoted to the development, structure and functions of man and his diseases. Comparative anatomy will be retained only as far as it throws light on the anatomy and functions of the human body in health and disease. Anthropology will be retained, but greater discrimination will be used in this subject. The Hunterian collection will be restored as far as possible by replacement of the destroyed specimens and by making copies of models based on records, illustrations or recollection. It will not be separately exhibited but distributed among the appropriate sections.

It is recommended that the museum shall consist of two sections—anatomy and pathology—and that the council shall establish chairs for the control of these: chairs of human and comparative anatomy and human and comparative pathology. For reconstituting the series of anatomic dissections the committee has obtained the help of leading teachers of anatomy. The object is to display the structure of the body from every possible aspect and at all ages, comprising normal (including microscopic) anatomy, topography and applied anatomy, surgical anatomy, embryology and senile changes. Restoration of the pathologic collections offers less difficulty. Selected members of the Royal Society of Medicine are being organized to make a systematic collection. Regional pathology will be developed primarily for the expert, as the needs of the student are largely met by the museums of the medical schools. There will be sections of military surgery, forensic medicine and industrial diseases; also a historical section, which will include Hunterian and post-Hunterian relics, and one devoted to the evolution of modern surgical instruments. A new feature is a series of x-ray films or lantern slides of films and exceptional cinematographic films of surgical conditions and operations.

RARE CHEMICALS

The following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

1. Sodium sulforicinate
2. Borneolglucuronic acid
3. p-Dimethylaminobenzophenone
4. p-Aminofuchsone
5. p-Dimethylaminofuchsone
6. p,p-Tetramethyldiaminofuchsone
7. N,N-Dimethylindigo $(C_6H_4C_2O\ N\text{-}CH_3)_2$
8. The (mono- or di-) methyl iodide or ethyl iodide addition products to No. 7 $[C_6H_4\ C_2O\ N\ (Ch_3)_2\ I]_2$
9. p-Toluquinaldine
10. 1-Methyl phenantroxazole
11. N-Ethyl-rhodanic acid
12. N-Methyl-rhodanic acid
13. N-Methyl-2-thio-4-keto-tetrahydro-oxazole
14. N-Ethyl-2-thio-4-keto-tetrahydro-oxazole
15. 2-Methyl-4-phenyl-oxazole

THE HEADQUARTERS BUILDING OF THE AMERICAN INSTITUTE OF PHYSICS

The American Institute of Physics has purchased a large, well-constructed, residential building at 57 East 55th Street, New York City, to be occupied as a national home office for the physicists of America. Generous contributions have already been made in a campaign that is now being conducted among American physicists and friends of physics throughout the nation to raise the necessary funds to meet the purchase price.

The seller of the property is Frederick Brown, a well-known real estate operator. It was largely because of Mr. Brown's generosity in setting the terms that the institute, which is a non-profit corporation, was enabled to make the purchase. The building was selected after a thorough search of suitable locations was made at the request of the purchaser by Paul S. Dixon, of the Equity Conservation Corporation, who arranged the transaction. Joshua Bernstein was the attorney representing the seller. The purchaser was represented by Robinson and Henson. Proposal for the purchase was first made by the Policy Committee of the institute.

This is the first time the organized profession of physics in America has owned a headquarters, the institute having occupied rented space since its founding in 1931. Need for the building arises from the phenomenal growth of the profession in the last twenty years. In that time physics has become recognized not only as a field of study and pure research but also as a science vitally important in industry. It has always been fundamental to other sciences, including engineering and chemistry.

---

[1] The *Journal* of the American Medical Association.

Developments for the war are serving especially to direct attention to physics and to the value of the physics profession to the nation. For example, the science of electronics is only one of the several branches of physics which are proving of great use in the war and hold even greater promise for post-war industrial developments. Other important branches of physics deal with optics, acoustics, x-rays, radio, spectroscopic analysis, cosmic rays and nuclear phenomena.

The American Institute of Physics is a federation of national societies including the following: the American Physical Society, the Optical Society of America, the Acoustical Society of America, the American Association of Physics Teachers and the Society of Rheology. Also associated with the institute are the American Society for X-Ray and Electron Diffraction and the Electron Microscope Society of America. The member societies and the institute publish eight technical journals which have a wide circulation throughout the world. These journals are *The Physical Review, Reviews of Modern Physics, Journal of the Optical Society of America, The Journal of the Acoustical Society of America, American Journal of Physics, The Review of Scientific Instruments, The Journal of Chemical Physics* and *The Journal of Applied Physics.* All of them are devoted to the publication of the results of research and their interpretation, of articles on the teaching of physics and the place of physics in the general culture of the modern world.

Aside from publication, the work of the institute deals with many services to physicists designed to advance the science and its contribution to modern life. These services include arrangement of meetings and conferences, furnishing information to the public and arranging cooperation with other scientific organizations and with agencies of the government. Recent war services have included authoritative assistance to the government in the use of the critical and insufficient physics manpower for war research and war operations in such fields as aircraft and submarine detection, anti-aircraft weapons, communication and secret developments.

Purchase of the building should materially accelerate a general plan of professional development in the field of physics, designed to meet post-war necessities. This plan was developed by the Policy Committee of the institute, whose members are Dr. Paul E. Klopsteg, president of the Central Scientific Company; Dr. Oliver E. Buckley, president of the Bell Telephone Laboratories; Dr. Karl T. Compton, president of the Massachusetts Institute of Technology; Dr. Homer L. Dodge, dean of the Graduate School of the University of Oklahoma, and Dr. R. Clifton Gibbs, chairman of the department of physics of Cornell University.

The plan contemplates the maintenance of high professional standards, the improvement of publications and meetings, efforts to improve the teaching of physics in high schools and colleges, the expansion of facilities and resources for research in the field of physics, rehabilitation of war-interrupted careers and extended activities designed to advance the science of physics and to facilitate the work of physicists in every way possible.

SCIENTIFIC NOTES AND NEWS

THE Frederick Ives Medal of the American Optical Society will be presented on October 8 to Dr. Lloyd A. Jones, of the Eastman Kodak Company, at the Pittsburgh meeting of the society, which will be held from October 7 to 9. The medal is awarded to Dr. Jones for "distinguished work in optics."

THE David B. Pickering Nova Medal of the American Association of Variable Star Observers was presented on September 11 to Professor Bernhard H. Dawson, of the Observatory of the National University of La Plata, for the discovery of Nova Puppis 1942. The presentation was made by Dr. Edward L. Reed, chargé d'affaires of the U. S. Embassy in Buenos Aires, at a ceremony in the new building and observatory of the Asociación Argentina Amigos de la Astronomía, a society of amateur astronomers, of which Dr. Dawson was president from 1932 to 1940.

ELLA CARR DELORIA, of New York, a Yankton Sioux Indian, since 1929 research specialist in the department of anthropology of Columbia University, received the 1943 Indian Achievement Medal on September 17, American Indian Day. The award is given annually by the Indian Council Fire of Chicago to an American Indian whose accomplishments are worthy of national recognition.

DR. WALTER H. EDDY, president of the American Institute of Food Products and consultant on food and nutrition to the quartermaster general, formerly professor of physiological chemistry at Columbia University, was recently the guest at a luncheon given in his honor at the Waldorf-Astoria, New York City.

WILLIAM RANDOLPH WALTON, senior entomologist of the Bureau of Entomology and Plant Quarantine,

U. S. Department of Agriculture, on reaching the age of seventy years has retired, his retirement to be effective on October 1, after thirty-three years of service in the Division of Cereal and Forage Insect Investigations, in which for seven years he was division leader.

PROFESSOR W. C. BRENKE, of the University of Nebraska, retired from the chairmanship of the department of mathematics on September 1. He is succeeded by Professor Ralph Hull, of the University of British Columbia. Dr. Brenke will continue his work as professor of mathematics during the current academic year.

DR. B. S. GUYTON retired as dean of the School of Medicine of the University of Mississippi at the end of August. He is succeeded by the assistant dean, Dr. James B. Looper.

DR. JACOB P. DEN HARTOG, previously associate professor in the School of Engineering of Harvard University, has been appointed professor of mechanical engineering at the Massachusetts Institute of Technology. He is now a Commander in the United States Naval Reserve and will be on leave of absence for the duration of the war to serve in the Bureau of Ships in Washington.

DR. JAMES L. WILSON, associate professor of pediatrics at the College of Medicine of Wayne University, has been appointed professor of pediatrics at the College of Medicine of New York University and chief of the children's medical service at Bellevue Hospital.

DR. PAUL F. HAHN, associate in biochemistry and experimental pathology at the School of Medicine of the University of Rochester, has become assistant professor of biochemistry at the School of Medicine of Vanderbilt University.

PROFESSOR HILTON A. SMITH, of Colorado State College, has been made associate professor of veterinary pathology at Iowa State College. Dr. Smith has also been a member of the faculties of the State College of Washington and of the Agricultural and Mechanical College of Texas.

DR. MAURICE L. TAINTER, director of research of the Winthrop Chemical Company, Rensselaer, N. Y., has been appointed professor of applied physiology at the Albany Medical College. This will not affect his relations with the Winthrop Chemical Company.

BERT H. NOREM has been appointed assistant professor of administrative engineering in the College of Applied Science of Syracuse University.

DR. ALLAN WATT DOWNIE, who since 1940 has been pathologist in charge of the Emergency Public Health Laboratory at Cambridge, England, has been appointed professor of bacteriology at the University of Liverpool.

THE Rockefeller Foundation has awarded a research grant to Dr. William C. Boyd, associate professor in biochemistry in the School of Medicine of Boston University, for the continuation of his research work on immuno-chemistry.

GILES E. HOPKINS has been appointed research manager of the Textile Research Institute. He replaces Malcolm E. Campbell, now dean of the textile school at North Carolina State College.

DR. BARRY G. KING, assistant professor of physiology at the College of Physicians and Surgeons of Columbia University, has accepted a commission as lieutenant in the U. S. Naval Reserve as physiologist. He will be engaged in medical research at the Naval Research Institute of the National Naval Medical Center, Bethesda, Md.

DR. E. CLIFFORD NELSON, parasitologist of the Department of Inland Fisheries and Game for the State of Maine, has been commissioned first lieutenant in the Sanitary Corps and has been assigned to Carlisle Barracks, Pa.

DR. J. S. KASANIN, director of the department of psychiatry of the Mount Zion Hospital, San Francisco, and assistant clinical professor of psychiatry at the Medical School of the University of California, has left for a two weeks' trip to El Paso, Texas. While in Texas, Dr. Kasanin will lecture under the auspices of the Rockefeller Foundation on psychosomatic medicine at the various U. S. Army hospitals of the Eighth Service Command.

FOR a second conference with the Surgeon General of the U. S. Army, Dr. Karl M. Bowman, professor of psychiatry at the Medical School of the University of California and director of the Langley Porter Clinic for mental diseases, San Francisco, has returned to Washington. He is serving as a member of a national committee concerned with the men rejected by induction boards for neuropsychiatric reasons. A report will be submitted to the government.

FACULTY members of the Michigan College of Mining and Technology at Houghton on leave for service in the armed forces include Commander J. H. Service, mathematics and physics; Lieutenant Commanders R. W. Drier, metallurgical engineering, and H. W. Risteen, mechanical engineering; Lieutenant C. J. Pratt, mathematics; Major F. A. Rohrman, chemical engineering; Lieutenants R. F. Lang, civil engineering, and T. E. Vichich, mathematics, and Corporal Vernon Johnson, forestry. Among faculty men on leave of absence as civilian employees of the Army is Professor George W. Swenson, head of the electrical engineering department. In addition, Professor A. K. Snelgrove, head of the department of geological engineering, and Professor N. H. Manderfield, of the department of mineral dressing, and his entire staff have been assigned to full-time research on strategic minerals. Associate Professors W. A. Seaman and V. L. Ayres of Dr. Snelgrove's staff devote half time to this project. Chemical engineering investigations, among them the recovery of copper and zinc from gilded metal scrap, also form a part of the war research program. This work is in charge of Professor H. L. Coles, head of the department, and to it he and three members of his staff—Dr. Glenn H. Damon and Dr. G. M. Machwart, associate professors, and E. R. Epperson, research engineer—are devoting most of their time.

Dr. Selig Hecht, professor of biophysics at Columbia University, gave an address entitled "Science in Everyday Life" at the opening ceremonies on September 21 of the New School for Social Research, New York City.

The eleventh E. Starr Judd lecture will be given by Major General Norman T. Kirk, Surgeon General, U. S. Army, War Department, at the University of Minnesota, on Monday evening, December 6, at 8:15 in the Museum of Natural History Auditorium. He will speak on "Surgery in War."

Sir Arthur Newsholme bequeathed the residue of his estate to the London School of Hygiene and Tropical Medicine.

The establishment of Leo F. Rettger Fellowships in the Yale Graduate School has been announced. The fellowships were founded by Dr. Leo F. Rettger, professor emeritus of bacteriology, who retired in June, 1942, after serving for forty years on the faculty. Well known for his researches on animal diseases and intestinal bacteriology, especially on the transformation of intestinal flora, he was the co-discoverer of acidophilous milk and received a patent on the process for producing it. The patent, Dr. Rettger explained, was secured not with the idea of limiting the production of acidophilous milk, but in order that the product might be controlled and made to conform to strict standards. The fund for the fellowships, amounting to $25,000, represents earnings since 1921 from the practical application of research under Dr. Rettger's supervision. Merrill Y. Van Wagoner, of Midway, Utah, and Irene E. Kuslowitz, of Baltimore, Md., have been appointed the first Rettger fellows.

A new course in personnel psychology, covering problems of selection and placement, including current applications of psychology to personnel problems of industry, the armed services and government agencies, will be offered jointly during the autumn term by the Graduate School of Arts and Science and the Graduate Division for Training in Public Service of New York University. The instructors, all associated with the Personnel Research Section, Classification and Replacement Branch, Adjutant General's Office, War Department, will be Lieutenant Colonel Marion W. Richardson, U. S. Army, officer in charge, Personnel Research Section; Captain Roger M. Bellows, U. S. Army, officer in charge, Technical Classification Unit, and Dr. Edwin R. Henry, chief, Technical Classification Unit. The course will be offered at the Washington Square Center each Wednesday evening for fifteen weeks.

Charles Pfizer and Company, of Brooklyn, N. Y., has purchased a refrigeration plant near its present property in order to expand the output of penicillin. It is planned to spend about $750,000 on the project, and highest priorities have been obtained for needed equipment, so that work may be completed by the end of this year if possible.

According to the *Journal* of the American Medical Association, the Department of Health of Mexico has signed an agreement with the School of Medicine of the Tulane University of Louisiana to establish and maintain a health unit and field training station at Boca del Rio, Vera Cruz, with a full-time resident director and staff. The unit will function as a health center for the welfare of the community and serve as a training center for physicians named by the Department of Health of Mexico, or by Tulane University with the approval of the Mexican department. Patients in the health unit of the city of Vera Cruz and in the hospitals there and those obtained through the facilities of the Institute of Tropical Diseases and other hospitals in Mexico, D. F., and clinic patients of Boca del Rio will be available for study. Funds to construct and equip the building at Boca del Rio will be provided by the Department of Public Health of Mexico and by Tulane University, but the department will provide funds to operate the health unit as such.

A preliminary statement of Scottish vital statistics for the second quarter of 1943, issued by the Registrar-General for Scotland and reported in *The Times*, London, shows that the birthrate was 20.4 per 1,000 of the estimated population. This is 1.1 above the comparable rate for the second quarter of 1942. It is 1.4 above the average for the corresponding quarter of the previous five years, and is the highest birth-rate recorded in the second quarter of any year since 1930. It is lower than the birth-rates experienced up till the end of the first quarter of this century. The death-rate was 12.7 per 1,000. This is 0.4 below that for the second quarter of 1942, and 0.5 below the five years' average. The marriage-rate was 7.8 per 1,000. This is 2.0 below that for the second quarter of 1942 but 0.2 above the pre-war five years' average. The infantile mortality rate was 58 per 1,000 births. It is 6 below that for the second quarter of 1942 and 10 below the five years' average. It is the lowest rate recorded for the second quarter of any year. The maternal mortality was 3.5 per 1,000 live births.

DISCUSSION

GEOLOGISTS IN WAR SERVICE

THERE has been some recent discussion in SCIENCE concerning the utilization of geologists in the war effort. Very few geologists are satisfied that the full value of the profession or of its personnel is appreciated. However, there has heretofore been an almost complete lack of information on which to base an intelligent discussion. Information on the prewar and wartime occupations of Harvard-trained geologists has been gathered. Data on 318 men are available, as shown in Table I.

TABLE I

Degrees	Total number	Teaching Per cent.	Non-commercial and government research Per cent.	Commercial research Per cent.	Changed position as result of war Per cent.
Ph.D. and S.D.	115	50	14	32	28
M.A. M.S. M.E.	79	32	18	46	32
Graduate School—no degree	73[*]	31	37	31	44[*]
A.B. and B.S.	51[†]	12	63	25	35
Totals	318	34	33	33	33

[*] Of this total 22 were students in 1941–42 and are omitted in calculating percentages, except in the final column.

[†] The present occupations of 93 other men with A.B. and B.S degrees are known. These men have gone into occupations other than geology or into the Army, and are not here listed.

Of the total of 318, a third each are employed as teachers, in non-commercial and governmental research and in commercial research. Only two of the teachers are in preparatory work; the rest are in college teaching. The per cent. of Ph.D.'s in this category is the highest, as men planning to teach usually attempt to doctorate. Many of those who have A.B. and A.M. degrees from Harvard hold doctors' degrees from other institutions.

The impact of the war has been severe, and there has been a shift of employment involving 33 per cent. of the total. The shift has been from commercial research into governmental research and administration or into the Army and Navy. Teachers have shifted mostly into commercial research, but most of the teachers have not shifted employment. They have, however, changed courses and adapted their teaching to new demands. Many have spent much time in temporary work for governmental bureaus or in commercial work or strategic minerals. It has been impossible to make estimates of these informal, confidential and part-time efforts, although their total value is large.

The proportion in the Army and Navy is fairly high: 10 doctors; 11 masters; 17 men with graduate work, and 5 bachelors who are recognized geologists or 13.5 per cent. of the total. Students who left college with bachelors' degrees to go directly into the Armed Forces are numerous but not considered. Some of these men intend to be geologists and have adequate training to be useful field assistants.

Of the group in uniform, 17 are mature men who are in specialized positions of research and administration which appear to be suitable to their talents. Men under 40, however, are mostly performing ordinary military or naval duties, for which they are presumably qualified, but which seem below their capacities. Every geologist believes that the Army and Navy need geologists as advisers on construction and on tactics and strategy. If these men were used as geologists, the situation would be more satisfactory. There are also others qualified and willing who could be recruited for duties in military geology.

These data cover the wartime changes in the occupation of a small group only, but a group presumably representative of the geologists who have graduated from other universities. The willingness of geologists to leave their ordinary occupations and assume new duties is obvious—a third have done so. That others are willing may be assumed. It appears, however, that a considerable fraction already in uniform are not being used to the best advantage. Many hesitate to change from one civilian position to another, but would shift to a uniform if they were to be used in a geologic staff.

KIRK BRYAN

CAMBRIDGE, MASS.

APPARENT TIME ACCELERATION WITH AGE

I AM interested in the article on "Apparent Time Acceleration with Age of the Individual," by F. W. Nitardy, appearing in SCIENCE for July 30. The theory set forth is "that elapsed time as measured by the recollection of an individual seemed long or short according to what relationship it had to the individual's total time experience." What is meant of course is a limited period of time in relation to the total time experience.

While the abstract lapse of time is a constant factor, it is not the only factor. The content of the lapsed time, that is, the events, occurrences, incidents and circumstances experienced during the period of lapsed time, is also a factor. Indeed, it would seem that it is more important than the mere lapse of time.

When the items of the content are new and strange, they appear to be longer in passing than when they are more or less familiar, even though they pass during the same period of time. It is well recognized, for example, that when one takes a first trip of an hour over a road new to the observer, it seems to the observer to take much longer than the same trip does at subsequent times. Also, when the items of the content are reduced to a minimum, as when one remains wakeful in a room for an hour with nothing to do, it seems a very long hour indeed.

The longer one lives the more familiar one becomes with many items which help to form the content of the lapse of time. Consequently, when the more or less familiar items pass in review, it seems to take them a shorter time than it seems to take at the beginning of life when everything is new.

If I remember correctly, some one once asked the late President Harding what phase of the Presidency impressed him most, and that his reply was the degree to which all his experiences in life prior to the Presidency were crowded out of his memory. In other words, because of the many and important items in the content of the lapse of time, a year as President seemed much longer than a year of his childhood then seemed.

It may also be observed that a brief period of danger may seem to be very long. I have heard it stated by boxers who were afraid of being knocked out that a round of the fight seemed like an age. It would appear that the content of the period of time is far more important than its actual length or than the ratio of the period to total elapsed time, in determining how long it seems to the observer.

Peter T. Dondlinger

In the issue of Science for July 30, 1943, F. W. Nitardy, proceeding from the assumption that as one grows older time seems to pass more rapidly, offers the ingenious explanation that each year has an apparent length inversely proportional to the number of years already stored in one's memory.

The assumption itself needs to be qualified; for there are at least limited circumstances in which the time-lapse sensation does not depend chiefly on age. A man of sixty and one of twenty, suffering extreme hardships on a life raft, expect to be rescued in due course. Is time likely to drag for Mr. Twenty but to plunge headlong for Mr. Sixty? Or consider a class one month before the end of the spring term. Pupil Twenty is to take some terrifying examinations and then to work on a job he loathes; and teacher Sixty will depart on a grand tour to which he has looked forward many years. Does age determine which wants a particular unit of time to creep and which to gallop? Some of Shakespeare's relevant observations are, of course, to be found in the second scene of the third act of "As You Like It."

To the extent that the assumption is sound, additional considerations for the subjective shortening of time are discernible. In one's earlier years there are apt to be numerous events (say, dates of parties, holidays, school graduations, marriage, childbirth, promotions) awaited so eagerly that one would be glad to forego the intervening period. After middle life, comparatively few such occasions remain, to be summoned posthaste out of the future. With the overwhelming distractions largely behind us, we are better able to appreciate time, and begin to concern ourselves with its pace.

Moreover, while our interests and associations multiply and we are troubled continually by the awareness of our multifaceted ignorance, the increasing disproportion between the innumerable things we ought or want to do and the few for which we shall have opportunity brings us to the unpalatable realization that time is shrinking.

Above all, there is the factor of apprehension. A decade ago the expression "Life begins at 40" was popularized by a book of that name. Whatever consolations the author may have adduced to support the title, realists know that at forty life begins to end, that they have then gone over the top of the hill and are coasting, brakeless, toward extinction. This is doubtless the primary reason why we oldsters are so dismayedly conscious of the precipitateness with which the years, months, weeks and days vanish. When young, we acted as if our balance in the bank of time were inexhaustible; we can delude ourselves no longer.

Frank Wilen

Brooklyn, N. Y.

For the apparent speed-up of time with increasing age of the individual, F. W. Nitardy (in Science, July 30) has a plausible explanation, perhaps the correct one. Other theories are possible. Shakespeare observed the facts even more broadly : witness the duet between Rosalind and Orlando:

> "Time travels in divers paces with divers persons" . . . .
> "Who does he gallop withal?"
> "With a thief to the gallows."

Balzac, in "Le Peau de Chagrin," shows impressively how to youth the inevitable end is a philosophical conception rather than one of the "facts of life," while as the aged approach that end the apparent speed of passage approaches the infinite. Youth looks forward and would "hasten the day"—of a party, of marriage, of economic competence. Age also looks forward, but to a constantly closer door never willingly approached. The apparent speed of time is warped in a direction opposite to that preferred. To youth it seems to move slowly, because youth would have it move rapidly. To age it seems to move rapidly because age would wish it to move slowly.

Or, to suggest another theory, we tend to measure the speed of time in terms of activity. Youth, on the average, is a period of limited interests and few internal resources. For the child, occupation must be found by some one else. He is easily and often bored. Time goes slowly with him. The adult has so much to do and think that time is never sufficient. It gallops away. Even the senile are fully occupied with issues of comfort and repose which are increasingly of concern to them. Thus time slips by with invisible swiftness.

W. D. ENNIS

STEVENS INSTITUTE OF TECHNOLOGY

FURTHER NOTE ON RUSSIAN NAMES

THE scientific worker with the problem of transliterating Russian names or identifying those transliterated by others will have been gratified by the recent attempts of Drs. Hrdlička (SCIENCE, 97: 243) and Dunlap (SCIENCE, 97: 400) to secure the adoption of a uniform method of transliteration. Certain points, however, need further clarification.

Dr. Dunlap's suggestion that we should be sensible and write "Павлов" as Pavloff" conforms neither with Dr. Hrdlička's recommendations nor with the accepted practice of transliterating into English letters most nearly representing the sounds of the Russian letters. In this case the final consonant in each syllable is the Russian "B," which equals the English "v," and "Pavlov" is the only correct English rendition possible.

When the initial of a Russian name is incorrectly transliterated in a bibliography or file, the reference appears at an incorrect position in the alphabetical arrangement and may be all but lost. "Vavilov" may be found misplaced as "Wawilow," or "Yarkina" as "I͡arkina" or "Jarkina."

The other Russian letters which are most frequently transliterated with confusing results are: "E," equal to the English "ye," as in "yet," with the English "e" reserved for "э"; "Ж," transliterated "zh" and pronounced as the "s" in "measure"; "И," equal to the English "i" and not "y"; "Ц," equal to the English "ts" and not to the German "z"; "Ю," equal to the English "yu" as in "yule"; and "я" equal to the English "ya" and not the awkward "i͡a" nor the German "j." For the Russian "Ц," the English "ch" as in "cherry" is adequate, is in customary use and retains English characters, available in all printing establishments, in contrast to the Slavic "č." (This note is restricted to Russian transliteration to avoid the dilemma of inconsistency on the one hand or, on the other, questioning of the right of so eminent an authority as Dr. Aleš Hrdlička to his preferred and long-established spelling of his own name.) There seems to be no alternative but that "щ" be rendered as "shch," clumsy as that may seem, while the Russian "X" is best transliterated as "kh" and aspirated as the German "ch" in "Bach." Had the Waterloo of this summer's Eastern front been properly rendered as "Oryol," we might have been spared some of the heroic but painful linguistic struggles of our radio commentators.

K. STARR CHESTER

OKLAHOMA A. AND M. COLLEGE,
STILLWATER

THE DIET OF CHINESE SOLDIERS AND COLLEGE STUDENTS IN WARTIME

A BRIEF account of the monotonous and simple diet of Chinese soldiers, with the diet of Chinese college students for comparison, will be given in these notes. The information may be useful for those working for practical nutrition and provoke thoughts of those who are interested in the science of human nutrition.

Based upon the 1,178 rations issued in 124 messes in South China in the spring of 1940 and the food consumption data of 11,338 soldiers for a month, a basic ration has been formulated. It consists of 953 grams of rice, 274 grams of leafy vegetables, 10 grams of fat and 13 grams of salt.

The ration provides probably enough calories for an adult having physical work, enough protein, nearly all from rice, and a very small amount of fat, which furnishes less than 3 per cent. of the total calories of the diet. It supplies sufficient iron, barely enough calcium and too much phosphorus from rice, thus with a Ca : P wider than 1 : 4. In regard to vitamins, it is worthy of note that practically only from the 274 grams of leafy vegetables the soldier gets his vitamin A in the form of carotene and vitamin C; and from the rice bran left on the low-grade rice he gets his antiberiberi vitamin. The actual vitamin intake can not be estimated correctly because of lack of analytical data and loss of vitamins through cooking.

The efficacy of this ration has been reflected on the nutritional state of soldiers based upon the measurements of 3,298 of them. Their height-weight relationship is just about normal for the average southern Chinese. According to medical examinations of the soldiers, the incidences of vitamin B deficiency are higher in those groups where polished rice is used or the rice water is wasted. It has been found that new recruits usually have a poorer nutritional state than seasoned soldiers, the explanation of which can not be based only upon diets.

Other dietary surveys made among troops at different localities of the rice-producing area and at different seasons of the year reveal that the formulated basic ration still holds true, except that leafy vegetable is not a constant item, roots being consumed when cheap leafy vegetable is not available. In that case, the vitamin A intake of the soldier probably will be cut to a very low level and the mineral intake too.

In regard to the diet of college students (man) in Kunming, a dietary record of 160 students for two months during different seasons shows that more varieties of foods are listed. An average ration consists of 423 grams of rice, 125 grams of leafy vegetables and tomato; 48 grams of tubers and roots, 68 grams of meat and eggs. It is a better diet than the soldiers' in respect to protein and fat, but still low in minerals and probably in vitamins too. The urine saturation test for vitamin C deficiency has been made. About 50 per cent. of the students tested can be grouped as sub-clinical cases of vitamin C deficiency. Among girl students, many frank cases of vitamin C deficiency have been reported by the school physicians and their bleeding and spongy gums have been promptly cured by intramuscular injection of large doses of ascorbic acid.[1] This nutritional study of the students leads to the supposition that the vitamin C nutrition of Chinese soldiers may be unsatisfactory too. One thing may be interesting to record. Almost no sugar is allowed the Chinese soldiers, and little is consumed.

T. SHEN

PHYSIOLOGICAL LABORATORY,
TSINGHUA UNIVERSITY,
KUNMING, CHINA

QUOTATIONS

SCIENCE AND INDUSTRY

AN urgent plea for a greater application of science to industry is made by Sir Harold Hartley in a comprehensive pamphlet entitled "Industrial Research: What it Means to Industry," which is being distributed among industrialists and may be obtained from the Federation of British Industries, 21, Tothill Street, S.W.1.

As a foreword states, it "is written in the confident belief that industrial research is going to be the vital factor in determining the future prosperity of Great Britain." This prosperity "will depend more than ever before upon the efficiency and progressiveness of our industries." The loss of foreign investments "will necessitate a considerable expansion in the value of our exports if we are to increase or even maintain our standard of living.

"This formidable task can only be achieved by using to the full our inventiveness and technical skill both to increase the efficiency of our older industries and to develop new commodities which will hold their own in the markets of the world." Compared with the nineteenth century, opportunities to-day are limited by the spread of industrialization and "because the easy inventions and obvious developments have already been made. . . . In the future the advantages Britain possesses in the skill and traditions of her craftsmen will depend more and more on the science that directs their efforts."

In this country there has not been a general appreciation of the value of science in industry, and the amounts spent on research—"the elixir of life of industry, ever renewing its youth and vigor"—have been correspondingly less than in Germany and the United States. This is in no way due to any lower standing of British science. "In both the world wars British scientists have proved that they can more than hold their own if they are given equal facilities and support. All they need is the same opportunity in peace as in war."

Industrialists will find the detailed account of the organization of research in this country of great interest and value. Making the point that business has a direct interest in seeing that research at universities and in technical colleges is adequately endowed, Sir Harold Hartley states that at any time in the university laboratories a new industry may be born which will meet some human need.

Here, too, we read that the technique of radiolocation was first devised and used for a purely scientific purpose without any thought of its practical application. The large and small industrial firm will find here full guidance on how to set about instituting research and what it will cost.

As to the dividend it will pay, the author points to results in war and peace. "It is estimated (he writes) that the gas-filled lamp developed by Langmuir represents an annual saving in the cost of domestic lighting in this country alone of £50,000,000. The improvement in the efficiency of the petrol engine due to lead ethyl saves over 2,000,000,000 gallons of petrol a year. The use of accelerators for vulcanizing rubber has saved capital outlay on moulds estimated at £16,000,000. Research on motor tires has increased their average life from 3,000 miles to over 20,000 miles.

"Naturally, these vast savings have been reflected in the profits and prosperity of the industries and firms responsible for these great technical advances. The first question any firm will ask is, What return can we expect from expenditure on research? The answer is partly given above, for there will always be brilliant prizes to be won. But the short answer is that no firm can afford to neglect research, as it is the only safeguard of the future."—*The Time*, London.

---

[1] The ascorbic acid used was a gift from Cornell University.

SCIENTIFIC BOOKS

SIR J. J. THOMSON

The Life of Sir J. J. Thomson. By LORD RAYLEIGH. x + 299 pp. Cambridge: At the University Press; New York: The Macmillan Company. 1943. $6.00.

IN this book Lord Rayleigh has not only given a dignified and colorful picture of one of the most outstanding pillars of science of the generation which has passed, but he has woven the picture into a most valuable historical development of those discoveries which have been the landmarks of the journey from the territory sown by Newton and Galileo to that in which we live to-day. Truly, in no epoch has the scenery changed as rapidly and with such enhancement in the richness of the foliage. There is absolutely no reason for the partial apology cited by the author in his preface and concerned with the book's being too scientific; for not only are scientific matters treated with a clarity which should leave no stumbling-blocks for the layman, but they are moulded with such skill with the personalities of their discoverers as to make them form a part of the story of the whole romance in which they figure as topics vying in interest, even to the layman, with those topics more particularly concerned with the personal life of J. J. Thomson himself.

Starting with Thomson's early youth, we find him obtaining a scholarship to Trinity College, Cambridge, when Clerk Maxwell was the director of the Cavendish Laboratory. It seems strange to realize that apparently he never met that great pioneer whose work formed so much of the basis of his later discoveries. It is also rather remarkable to learn that he had so little scientific contact with Sir Joseph Larmor, who was his life's contemporary, interested in the same fields of science, but to some extent in the more abstract domains thereof. Thomson himself was a mathematical physicist of no mean order of attainment, as his earlier writings very fully demonstrate. Indeed, later, when, on the retirement of the late Lord Rayleigh from the Cavendish professorship, he was appointed to that position at the early age of twenty-eight, not over-enthusiastic letters of congratulation from some of his rivals for the position expressed surprise at the appointment, founded upon the assumption that he was a mathematician rather than a physicist. It is true that none of his fellow workers, even then or since, have regarded him as much of a manipulator of apparatus. We read that "He had little knowledge of mechanical processes and technique and was at no time ready with his hands." His actual experimental work was always carried out by an assistant, and he was indeed fortunate in his choice of these men. One of them, H. F. Newell, however, writes: "J. J. was very awkward with his fingers, and I found it very necessary not to encourage him to handle the instruments! But he was very helpful in talking over the ways in which he thought things ought to go." We learn that he was an excellent elementary lecturer and insisted upon the importance of numerical examples.

In these days of elaborate equipment, it is interesting to read his account of the difficulties encountered in his very early days as a student of Balfour Stewart at Manchester, for he writes: "It may be worthy of remark that as many of the pieces of apparatus used were required for the ordinary work of the laboratory, the whole arrangement had to be taken down and put together again between each determination." An experienced experimntal physicist of to-day would rather demur against his additional remark on the supposed advantages of this procedure to the effect that "this must have had the effect of getting rid of a good many accidental errors." Even in 1914, after the major portion of his work as Cavendish professor had been completed, we read that about thirty research students were working in the laboratory and the cost of their researches was about £300 ($1,500) per annum.

It is generally recognized that J. J.'s influence in the Cavendish Laboratory was mainly one of general stimulation and encouragement, and that his advice frequently did not extend in useful form down to practical details. This phase is dealt with in entertaining vein with a full understanding that one who can be great in many things can afford his weaknesses in a few. We read of his advising the student to measure the diameter of a quartz fiber by wrapping a spiral thread around it and measuring the length. We read of his conversation with John Zeleny, who had just succeeded in the then by no means easy feat of getting results on ion mobilities for atmospheric ions, and we find him suggesting that results be secured for metallic vapors and coming round, moreover, a few hours later wanting to know if such results had been obtained. We learn that he considered a slide rule a device for wasting time, and he apparently never used one. On the other hand, there are various citations of profound wisdom and understanding. To a student who complained how uphill research was, he replied: "Yes, that is why there is so much credit in doing anything." We find him deploring the fact that research students of to-day require so much. "They expect," he said, "to be given a properly designed piece of apparatus which will *work*. In the earlier days we had to make it work ourselves as best we could, whatever its natural deficiencies might be." We find him dilating upon the position of industrial research and upon the dangers of fundamental research being done under conditions in which the researcher is paid for his efforts. He ends by stating: "You want this kind of research, but if you pay a man to do it, it will drive him to research of a different kind. The only thing to do is to pay him for doing something else and give him enough leisure to do research for the love of it."

J. J., while a radical in the physics of mid-Victorian times, was very conservative in his own radicalness, and was never happy with even the older quantum theory, apart from the new. We find him quoted as saying in a letter: "Again, I differ from you about the value of the conception of an ether, the more I think of it the more I value it. I regard the ether as the working system of the universe. I think all mass, momentum and energy are seated there, . . ." It would have been perhaps interesting if the book had included some reference to Niels Bohr's association with the Cavendish Laboratory.

Like many of the famous physicists of the nineteenth and early twentieth centuries, J. J. was for a time interested in psychical investigations and is even sufficiently sympathetic towards the phenomenon of water divining to remark that there is no doubt of the reality of the process of "dowsing."

The period of transition between Thomson's resignation of the directorship of the Cavendish Laboratory and the appointment of Rutherford is one which must have been fraught with many delicate considerations. Thomson, having retired from the directorship of the Cavendish Laboratory, had assumed an independent professorship, and the ironing out of responsibilities between a new director as forceful in personality as Rutherford and a retired director as eminent as J. J., and who was still active in the laboratory, must evidently have necessitated rather difficult diplomatic adjustments. Thomson was very evidently anxious to have Rutherford accept the directorship, and his own characteristic modesty is well exemplified by his remarking, in connection with the potentialities which the post afforded, that: "There are very great opportunities for making a very great school of physics at Cambridge. . . ." As the author remarks, Thomson, in this phase, "does not give the slightest hint of what was obviously the fact, that he himself *had* made a very great school of physics at Cambridge, and that the problem for his successor was to maintain it."

It will come as a surprise to many that in spite of the relatively small emoluments pertaining to even such a distinguished man of science, emoluments which do not appear to have been supplemented from such extraneous sources as patents or independent professional activities, J. J. Thomson's will was ultimately proved for no less a sum than 82,000 pounds sterling, which Lord Rayleigh attributes to a skill in investments which would have caused him to have attained distinction in the business world of affairs if he had chosen that line instead of science.

The author stresses everywhere the fact of J. J.'s informality, simplicity and the lovableness of his disposition. We see a man whose great influence on science has come as much through the permeation of his great spirit into the souls of those who surrounded him as by his own researches and formal writings. In reading the book one is conscious, in the reverence and love which the writer shows for his great master, of the absorption within himself of something of that spirit.

W. F. G. Swann

ORGANIC CHEMISTRY

Textbook of Organic Chemistry. By George Holmes Richter. Second edition. 6¼ × 9¼ in. 759 pp. Artistically bound in gray and blue cloth. New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd. 1943. $4.00.

The new edition of this excellent text, in its very attractive blue and gray binding, will be warmly welcomed by all who have used or are familiar with its predecessor, which appeared just five years ago.

The changes made in the older edition consist mainly in the rearrangement of old and the addition of new subject-matter. Thus, the discussion of natural products, previously scattered through various chapters, has been assembled in a single chapter and a new section on terpenes added. Many other similar illustrations might be cited. As to new matter, supplementary information has been provided concerning hormones, vitamins, drugs, plastics (including synthetic rubbers), hydrocarbons, gasoline, octane ratings of fuels and halogenation; as well as resonance, tautomerism, the reactions of Claisen, Elbs, Scholl and Stephen; and the rearrangements of Demjanow, Jacobsen and Wagner.

The book is warmly recommended as one of the best in its class.

The Chemistry of the Aliphatic Orthoesters. By Howard W. Post. American Chemical Society, Monograph Series, No. 92. 6¼ × 9¼ in. 188 pp. Bound in dark blue cloth. New York: Reinhold Publishing Corporation. 1943. $4.00.

The volume comprises the following chapters: 1. Introduction; 2. Preparation and General Properties; 3. Reactions with or Catalyzed by Inorganic Acidic Substances; 4. Reactions with Organic Acids, Anhydrides and Halides; 5. Reactions with Nitrogen Compounds; 6. Reactions with Organo-metallic Compounds; 7. Carbohydrate Orthoesters and Orthoacids; 8. Miscellaneous Reactions; 9. Silicoörthoesters: Preparation and Physical Properties; 10. Chemical Properties of Silicoörthoesters; 11. Polyalkoxides of Other Elements of the Fourth Column; and 12. Physical Properties of Orthoesters. An author index and a subject index conclude the work. Numerous tables are distributed throughout the text, and every chapter, except the first one, concludes with an extensive bibliography.

The book is a comprehensive and scholarly compilation and presentation of information widely scattered in chemical literature, and not heretofore brought together in a single volume so far as the reviewer is aware. Our present knowledge of the esters of orthoformic acid, $HC(OR)_3$, of its homologs and of orthocarbonic acid, $C(OR)_4$, has been painstakingly gathered, classified and reviewed. Two chapters are devoted to the silicon analogs of these esters; and one to the polyalkoxides of other elements of the fourth column of the Periodic Table; *viz.* Ti, Ge, Zr, Sn and Pb.

The subject-matter is classified primarily according to the preparation method or type of reaction involved, rather than on the basis of the compounds discussed, and secondarily in chronological sequence.

The author calls attention to the remarkable agreement between the b.p. of a given orthoester and that of its silicon analog, to the stability of the carbon-silicon bond in such compounds and to the fact that silicoörthoesters are subject to hydrolysis in much the same manner as the corresponding carbon compounds.

A valuable and stimulating feature of the book is the attention called to problems in this field which still await solution. The final chapter, on the physical properties of orthoesters, consists of a list of known orthoesters, arranged according to molecular formulas on the Richter-Stelzner Lexikon plan, recording all known physical data, and with a bibliography of 391 titles.

In its chosen field, the volume is in a class by itself and is certainly indispensable to all interested in any way in the chemistry of the aliphatic orthoesters.

Marston Taylor Bogert

Columbia University

SOCIETIES AND MEETINGS

THE VIRGINIA ACADEMY OF SCIENCE

The twenty-first annual meeting of the Virginia Academy of Science was held in Richmond on May 12 and 13. It was held in the middle of the week to avoid week-end congestion and in Richmond as an easily accessible place. It was foreseen that it could not be a full-sized, regular meeting and yet 204 registered out of a membership of 800, and seven of the ten sections put on programs.

A group interested in starting a section on statistical methods presented a qualifying program of ten papers.

Three committees were appointed: A committee to function as the Virginia part of the larger committee of the Southern Association of Science and Industry, which is making a survey of the natural resources of the South. A committee to prepare data concerning the natural resources of Virginia for the use and instruction of the school children of the state. A committee appointed, upon invitation of the Virginia Commission of Game and Inland Fisheries, to cooperate with state agencies concerned with conservation.

A special address was delivered on Wednesday night on the "Demographic, Economic, and Social Characteristics of the James River Basin" by Drs. Lorin A. Thompson and Joseph B. Gittler, of the Virginia State Planning Board.

The Virginia Academy of Science Award of $50 was given to Dr. J. B. Myers, of the Blandy Experimental Farm of the University of Virginia, for a paper entitled "Cytogenetics of Phlox," and the Jefferson Prize of $50 was given to Mr. Walter H. Hough, of the Virginia Agricultural Experiment Station at Winchester, Va., for a paper entitled "Development of Vigorous or Resistant Strains of the Codling Moth."

The crowning event occurred at the academy luncheon on Wednesday, when 125 were present. Friends of the academy had offered to contribute $200 a year to the work of the research committee, provided the academy would contribute an additional $400. When this was announced, pledges came in so rapidly that more than the required amount was raised in less than five minutes. No record was made of these oral pledges, but $639 has come in and has been deposited in the bank. This will about double the amount of money the research committee will have available each year for the encouragement of research in Virginia.

The officers elected were the following: Major W. Catesby Jones, *President;* Dr. Robert F. Smart, *President-Elect;* Dr. E. C. L. Miller, *Secretary-Treasurer;* Dr. Sidney S. Negus, *Assistant Secretary.*

E. C. L. MILLER,
Secretary

SPECIAL ARTICLES

ISOLATION AND CHARACTERIZATION OF INFLUENZA VIRUS B (LEE STRAIN)[1]

THE influenza virus A (PR8 strain) has been isolated from virus-infected chick embryo chorio-allantoic fluid in preparations of high homogeneity with respect to particle kind.[2] The particles, which behaved as the virus and which consisted of a lipoprotein complex containing nucleic acid of the desoxypentose type, were revealed in the electron microscope as ovoid or kidney-shaped images of variable size corresponding to particles of 77.6 mμ average diameter. Sedimentation velocity diagrams showed a single slightly diffuse boundary. The sedimentation constant was $S_{20^\circ} = 724 \times 10^{13}$, which with the assumption of a spherical shape for the particles and a density of 1.2,[3] gave a value of 80 mμ for the particle diameter. In the present paper are described briefly the results of similar studies of the Lee strain of the influenza virus B.

The influenza virus B was cultivated in the chorio-allantoic sac of 11-day-old chick embryos. After 42 to 48 hours' incubation at 37° C. following inoculation with the virus, the chorio-allantoic fluid was drawn off, cleared of aggregates by angle centrifugation, dialyzed 24 hours at 2–5° C. against flowing Ringer-calcium chloride solution,[2] and cleared again by angle centrifugation. The fluid was adsorbed twice with adult chicken red blood cells from which the virus was eluted in one fourth the original volume for 2.5 hours at room temperature (24 to 28° C.). The eluate was twice adsorbed in like manner and elution carried out as before. The second eluate was then ultracentrifuged at 27,000 g for one hour, and the resulting pellets were dissolved at 150 times concentration with respect to volume. The pellet suspension was spun at 11,000 g for 2 minutes to remove aggregated material.

In this process, practically all the red blood cell agglutinating capacity and the infectious properties of the chorio-allantoic fluid were carried into the second eluate. Ultracentrifugation of the eluate at 27,000 g for 1 hour resulted in sedimentation of about 90 per cent. of these biological characters. The low-speed centrifugation at 11,000 g was associated with a further small loss of the red blood cell agglutinating capacity and infectivity, leaving about 40 to 70 per cent. of these properties in the clarified concentrates. The concentrates reacted specifically in complement fixation and precipitation reactions with the sera of ferrets and rabbits immunized with mouse lung infected with this strain of the virus.

Electron micrographs of the purified virus concentrates showed rounded or ovoid images of variable size indicating an average particle diameter of 98 mμ. Exceedingly little extraneous material was present. Definite differentiation of structure within the individual particles was indicated by an approximately centrally placed area of relatively high density. The chorio-allantoic fluid and the inactive fractions—the supernate after adsorption with red blood cells and the supernate of ultracentrifugation—contained large numbers of amorphous particles of all sizes, but many especially of about 40 mμ to approximately the size of the virus particle. Particles of this range of diameter were not seen in chorio-allantoic fluid from normal embryos or in the fluid or comparable fractions of it from embryos infected with influenza virus A.[2]

Sedimentation velocity diagrams showed a single slightly diffuse boundary corresponding to a sedimentation constant of $S_{20^\circ} = 832 \times 10^{-13}$. From the sedimentation constant and the specific volume, 0.865, determined by pyknometer measurement, assuming a spherical shape, the calculated particle diameter was 100 mμ.

Suspensions of the concentrated material were opalescent and bluish. Positive biuret, ninhydrin and Millon tests were obtained. The glyoxylic acid and Molisch tests were negative. A positive reaction was seen in Bial's reagent after hydrolysis of the material with 10 per cent. sulfuric acid. This and a weakly positive Dische diphenylamine reaction indicate the presence of desoxypentose. The nitrogen content of the material dehydrated over P_2O_5 varied from 9.6 to 10.4 per cent.

---

[1] This work was aided by the Dorothy Beard Research Fund and by a grant to Duke University from Lederle Laboratories, Inc., Pearl River, N. Y. The investigation was also supported through the Commission on Acute Respiratory Diseases, Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army, Preventive Medicine Service, Office of the Surgeon General, U. S. Army, and by grants from the Commonwealth Fund, the W. K. Kellogg Foundation, the John and Mary R. Markle Foundation and the International Health Division of the Rockefeller Foundation to the Board for the Investigation and Control of Influenza and Other Epidemic Diseases for the Commission on Acute Respiratory Diseases.

[2] A. R. Taylor, D. G. Sharp, D. Beard, J. W. Beard, J. H. Dingle and A. E. Feller, *Jour. Immunol.*, in press.

[3] W. J. Elford and C. H. Andrewes, *Brit. Jour. Exp. Path.*, 17: 422, 1936.

In preliminary chemical studies, fractionation by the procedures of Kirk[4] and Kirk, Page and Van Slyke[5] showed that about 20 per cent. of the material were soluble in petroleum ether. Of this, 5.7 per cent. were in the form of neutral fat, 10.2 per cent. were phospholipid and 5.1 per cent. cholesterol. The alcohol-ether insoluble fraction constituted about 65 per cent. of the material and contained phosphorus to the extent of 0.27 per cent. of the whole virus. If all this phosphorus were present in nucleic acid, the whole virus complex would contain about 3 per cent. nucleic acid.

The yield of the purified material in all experiments averaged about 2 mg per 100 cc of chorio-allantoic fluid. On the basis of nitrogen precipitable with trichloracetic acid the degree of concentration for practical conditions was about 20 times and on the basis of volume it was 150 times. The specific 50 per cent. point infectivity for chick embryos varied from $10^{-11.2}$ to $10^{-12.1}$ grams per 0.1 cc inoculum with an average of $10^{-11.4}$ grams corresponding to 6,600 particles. The quantity of virus giving the 2_{+} red blood cell agglutination end point was $10^{-6.5}$ grams.

The findings indicate that the influenza virus B is a relatively large particulate complex consisting of lipoprotein with which is associated nucleic acid of the desoxypentose type. From electron micrography, the average diameter of the spherical or ovoid bodies was 98 mμ. The diameter calculated from the sedimentation constant, $S_{20^{\circ}} = 832 \times 10^{-13}$, the specific volume, 0.865, and an assumed spherical shape was 100 mμ. The influenza virus B (Lee strain) thus appears to be significantly larger than the influenza virus A (PR8 strain).

D. G. Sharp
A. R. Taylor
I. W. McLean, Jr.[6]
Dorothy Beard
J. W. Beard[7]
A. E. Feller[7]
John H. Dingle[7]

Department of Surgery,
Duke University School of Medicine
and
Respiratory Diseases Commission Laboratory,
Station Hospital, Section 2, Fort Bragg, N. C.

THE ETHER SOLUBLE FRACTION OF NAVY BEANS AND THE DIGESTION OF STARCH

During the course of experiments dealing with the digestibility of dried navy beans it was observed that the oil of these beans retards the digestion of soluble starch by pancreatic amylase *in vitro*. The degree of this action appears to be of sufficient magnitude to warrant detailed study and comparison with other fats. It was also found that the retarding influence of the bean oil can be overcome to a large degree by a treatment with yeast. The object of this preliminary note is to briefly describe some of these findings.

Oil having these interfering properties can be readily obtained by extracting finely ground navy beans with ether for about one week. The total fat-soluble fraction when added to soluble starch in the same concentration in which it occurs in the beans retards the digestion of the starch more than some of the other edible fats. The amount of pancreatic amylase which completely digests 50 cc of a 1 per cent. solution of untreated soluble starch at pH 7 in less than thirty minutes *in vitro* leaves the treated starch incompletely digested after forty-eight hours.

Starch impregnated with the same amount of butter, lard or olive oil shows a negative starch-iodine test at about the same time as the untreated control. These findings are summarized in Table I. The oil which is quickly extracted from coarsely ground beans instead of allowing the usual period of one week for extraction does not retard the digestion. The difference in digestibility can not be attributed to the action of the ether on the oil.

TABLE I

Fat added to starch in concentration of 1.5 per cent.	Starch-iodine test	
	½ hour digestion	48 hours digestion
bean oil	strongly positive	strongly positive
lard	negative	negative
butter	negative	negative
olive oil	negative	negative

The amount of starch which remains undigested in the presence of the bean oil varies with the age of the starch-oil preparation. In fresh preparations about half of it is undigested after two hours under the above conditions. As the age of the preparation increases the starch becomes less digestible until the inhibition is essentially complete in those preparations which have stood several months. A similar preparation of starch and olive oil becomes less digestible after standing for an equal period but is considerably more digestible than the starch impregnated with bean oil. The relative difficulty with which the interfering factor in the bean oil is extracted from the beans and its increased effectiveness as the starch-oil preparations age suggests that the firmness of the association of the oil with the starch may account for its action.

---

[4] E. Kirk, *Jour. Biol. Chem.*, 106: 191, 1934.

[5] E. Kirk, I. H. Page and D. D. Van Slyke, *Jour. Biol. Chem.*, 106: 203, 1934.

[6] Fellow in virus research, Division of Medical Sciences of the National Research Council.

[7] Representing the Commission on Acute Respiratory Diseases, whose other members are Drs. T. J. Abernethy, G. F. Badger, N. L. Cressy, Captain, M. C., A. D. Langmuir, C. H. Rammelkamp, J. M. Ruegsegger and E. Strauss.

Various means of overcoming this interference were tried. The method which appears to be most practical from a nutritional point of view involves a preliminary treatment with yeast. After incubating the undissolved starch-oil preparation with yeast and heating the preparation at 100° for 30 minutes the starch treated with bean oil is then digested by pancreatic amylase at about the same rate as untreated starch. This is true for both new and old starch-oil preparations. The yeast employed does not significantly digest the starch nor does the heated yeast hydrolyze maltose. Likewise, a similar treatment of whole navy beans approximately doubles the rate of hydrolysis of the bean starch by pancreatic amylase. In this respect the treated beans compare more favorably with other common starchy foods. Heating the beans in dilute acid followed by neutralization further compensates for the delayed digestion. It is believed that a similar fat-soluble factor occurs in some other foods and preliminary studies indicate that other enzymes are influenced by this substance. It appears to be especially prominent in soybeans.

In view of some of the present nutritional problems and the increased use of soybeans the significance of this factor is being studied in detail.

DONALD E. BOWMAN
DEPARTMENT OF BIOCHEMISTRY AND PHARMACOLOGY,
INDIANA UNIVERSITY SCHOOL OF MEDICINE,
INDIANAPOLIS

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE PROTECTIVE ACTION OF GLUCOSE IN BOVINE PLASMA AGAINST HEAT COAGULATION[1]

BEILINSSON[2] found that sucrose and glycerol inhibited the heat coagulation of egg albumin. Newton and Brown[3] showed that sucrose and glucose prevented coagulation of plant sap proteins by freezing. The protective action of other sugars against heat coagulation of egg albumin and the nature of the protection have been investigated.[4]

Van Der Scheer and co-workers[5] have studied the changes occurring in horse serum when it is heated to 60° to 65° C. for short intervals. They were able to show the presence of a new component by electrophoretic analysis. The new component was labeled "C." Evidence was presented to show that this component was a colloidal aggregation product resulting from the denaturation of constituents in the serum.

The present study demonstrates the protective action of glucose against the formation of the "C" component in heated bovine plasma by using the moving boundary technique of electrophoretic analysis.[6]

Normal bovine plasma obtained from citrated blood was utilized. One aliquot of the plasma was saturated at room temperature with glucose, stoppered and then heated at 65° C. for one hour in a constant temperature water-bath. At the end of this period of heating, the sample was perfectly clear and no coagulation was evident. The glucose was removed by dialysis against physiological salt solution. A second aliquot was heated in its native form under the same conditions. However, in this case a coagulum formed during the heating period which was later removed by centrifugation. The remaining aliquot was not heated and served as a control. The three samples were then adjusted to a protein concentration of 2 per cent. and dialyzed for 3 days against large volumes of a diethyl barbituric acid—sodium diethyl barbiturate buffer of pH 8.6 and 0.1 ionic strength. Electrophoretic analyses of the samples were then carried out in a manner previously described at 0° C. for 10,000 seconds at a potential gradient of 6 volts.[7]

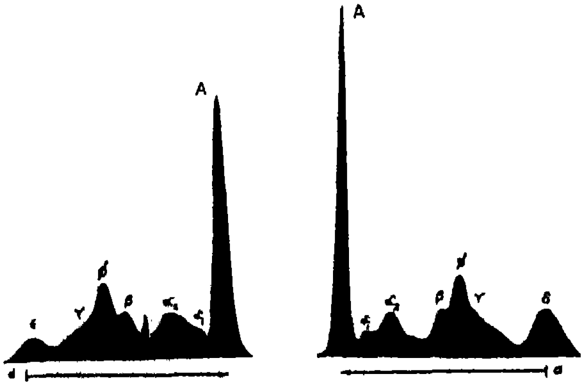


FIG. 1

---

[1] From the Bacteriology Section of the Michigan Agricultural Experimental Station and the Kedzie Chemical Laboratory, East Lansing, Michigan. Journal article No. 652 from Michigan Agricultural Experiment Station.

[2] A. Beilinsson, *Biochem. Zeits.*, 213: 399, 1929.

[3] R. Newton and W. R. Brown, *Can. Jour. Research*, 5: 87, 1931.

[4] C. D. Ball, C. R. Hardt, R. J. Westfall and W. J. Duddles. In process of publication.

[5] J. Van Der Scheer, R. W. Wyckoff and F. L. Clarke, *Jour. of Immunol.*, 40: 39, 1941.

[6] A. Tiselius, *Trans. Faraday Soc.*, 33: 524, 1937.

[7] C. L. San Clemente and I. F. Huddleson, *Mich. Agr. Exp. Sta. Bul.* 182, p. 3, 1943.

Fig. 1 shows the electrophoretic pattern obtained from the normal unheated plasma. Fig. 2 was obtained from the sample that was heated for one hour at 65° C. in the absence of glucose. A decrease in the areas of all the visible constituents as compared with the normal plasma in Fig. 1 is evident. The "C" component appears in the region of the alpha globulins, and its concentration is such that the peak on the ascending side extends beyond the plate. Fig. 3 shows the effect of heating the plasma in the presence of saturated glucose. The pattern does not show the "C" component after this condition of heating. However, the fibrinogen, beta and gamma globulin areas have decreased while a small new peak (x) is observed in the descending pattern next to the alpha-2 globulin.

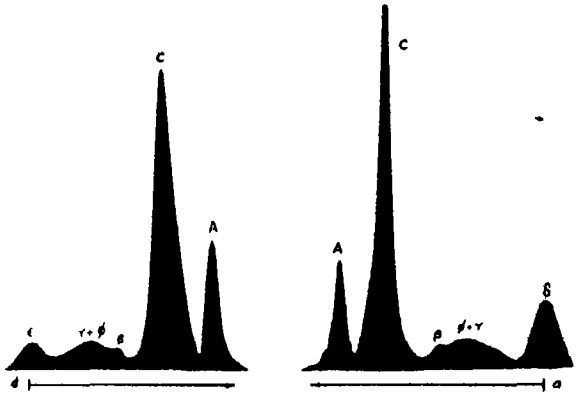


Fig. 2

The sharp peaks (y) near the beta globulin patterns may have originated from normal constituents in the plasma whose properties have been changed by the heating process or they may represent lipide disturbances.

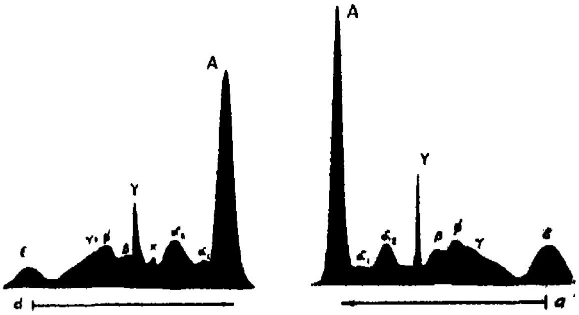


Fig. 3

In Table 1 are set forth the calculated mobilities of the components of the different samples. There is close agreement between values for all plasma samples. No significant differences in mobilities have been observed between normal plasma and plasma heated at 65° C. in the presence of saturated glucose.

TABLE 1

Sample description	Mobilities u × 10⁻⁵									
	A	α^1	α^2	C	x	y	β	ϕ	γ	$\phi+\gamma$
Normal plasma	6.78	6.04	5.35				3.53	2.75	2.48	
Plasma and glucose heated at 65° C	6.55	5.82	4.81		4.16	3.60	3.31	2.62	2.11	
Plasma heated at 65° C	6.86			5.08			3.39			2.34

It is believed that the protective action of glucose against the heat coagulation of plasma proteins may be of considerable significance in studies pertaining to proteins. Further investigations of this nature are in progress and will be reported on at a later date.

Chester R. Hardt
I. Forest Huddleson
Charles D. Ball

BOOKS RECEIVED

Bloor, W. R. *Biochemistry of the Fatty Acids and Their Compounds, the Lipids.* Pp. xi + 387. Reinhold Publishing Corporation. $6.00.

Carnegie Institution of Washington Publication 555. Biological Results of the Last Cruise of the Carnegie. Illustrated. Pp. v + 92. $1.00, paper cover; $1.50, cloth binding.

Clancey, Vernon J. *Chemistry and the Aeroplane.* Illustrated. Pp. vi + 176. The Ronald Press Company. $2.25.

Conklin, Edwin Grant. *Man: Real and Ideal.* Pp. xvii + 247. Charles Scribner's Sons. $2.50.

Graham, Herbert W. *Studies in the Morphology, Taxonomy and Ecology of the Peridiniales.* Publicatio. No. 642. Illustrated. Pp. vii + 129. Carnegie Institution of Washington. $1.50, paper cover; $2.00, cloth binding.

Hector, L. Grant, Herbert S. Lein and Clifford E. Scouten. *Electronic Physics.* Pp. viii + 355. Illustrated. Blakiston Company. $3.75.

Humphreys, W. J. *Fogs, Clouds and Aviation.* Illustrated. Pp. xii + 200. Williams and Wilkins Co. $3.00.

Jacobs, Woodrow C. and Katherine B. Clarke. *Meteorological Results of Cruise VII of the Carnegie, 1928–1929.* Publication No. 544. Illustrated. Pp. iv + 168. Carnegie Institution of Washington. $1.50, paper cover; $2.00, cloth binding.

Krieger, Herbert W. *Island Peoples of the Western Pacific Micronesia and Melanesia.* Illustrated. Pp. iv + 104. Smithsonian Institution.

Leighton, Henry L. C. *Solid Geometry and Spherical Trigonometry.* Illustrated. Pp. xix + 210. D. Van Nostrand Company. $2.20.

Petersen, William F. *Lincoln Douglas, The Weather as Destiny.* Illustrated. Pp. x + 207. Charles C Thomas. $3.00.

Small, Sidney Aylmer and Charles Ramsey Clark. *Simplified Physics.* Illustrated. Pp. x + 428. E. P. Dutton and Co. $3.00.

Strong, Everett M. *Electrical Engineering Basic Analysis.* Illustrated. Pp. xii + 391. John Wiley and Sons. $4.00.

Thomson, Andrew. *Upper-Wind Observations and Results Obtained on Cruise VII of the Carnegie.* Publication No. 547. Illustrated. Pp. vii + 93. $0.75, paper cover; $1.00, cloth binding.

Weeks, Arthur W. and H. Gray Funkhouser. *Plane Trigonometry.* Illustrated. Pp. viii + 193. D. Van Nostrand Co. $1.75.

SCIENCE

VOL. 98 FRIDAY, OCTOBER 8, 1943 No. 2545

Recent Anthropology: THE LATE PROFESSOR FRANZ BOAS ... 311

Running Records: DR. ALFRED W. FRANCIS ... 315

Obituary:

Lewellys F. Barker: DR. WARFIELD T. LONGCOPE. *Recent Deaths* ... 316

Scientific Events:

Aircraft Production in Great Britain; Ophthalmological Research at the University of Oxford; Rehabilitation Clinics at the New York Hospital; New Floras Published by the New York Botanical Garden and the Utah State College; A Visiting Professor to China; The Autumn Meeting of the American Philosophical Society ... 318

Scientific Notes and News ... 320

Discussion:

The Census Bureau and the Great Lakes Area Situation: DR. CHASE S. OSBORN and STELLANOVA OSBORN. *Scale Curves in Cartography:* PROFESSOR EDWARD KASNER and PROFESSOR JOHN DE CICCO. *Vitamin C from Evergreens:* DR. WOLCOTT B. DUNHAM. *Spans Two Continents:* JOHN P. HARRINGTON ... 323

Scientific Books:

Structural Geology: PROFESSOR WALTER H. BUCHER 325

Special Articles:

Biological Effects of a Toxic and a Sensitizing Substance Isolated from Paraffin Oil Extract of Dead Tubercle Bacilli: DR. NINE CHOUCROUN. *An Inoculated Penicillin Dressing:* DR. GEORGE H. ROBINSON and JAS. E. WALLACE ... 327

Scientific Apparatus and Laboratory Methods:

An Automatic Flow Switch for Water-Cooled Apparatus: ROMEO W. GOULEY ... 330

Science News ... 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

RECENT ANTHROPOLOGY[1]

By the late Professor FRANZ BOAS

FROM time to time I have found it useful to reexamine the general principles which I have been following in my scientific work and to compare them with new tendencies which were springing up in our own and related sciences and which were modifying and extending both the field of our researches and the methods of investigation. It so happens that I have stated the results of such reexamination of principles at intervals of about ten years, beginning in 1888 with the acceptance of views generally held by ethnologists of that period. The last time I gave such a review was in 1932. I have been asked to give to-day a similar review of the problems and methods of anthropology as I see them.

Before the development of field research, planned for the investigation of specific, detailed problems, the endeavor of the field worker used to be primarily to obtain information, as complete as possible, regarding the types of bodily build, of linguistic expression and of other cultural features that set off one human society from others. In 1888, when I was charged by the British Association for the Advancement of Science with an investigation of the Indians of British Columbia, a summary report on the types and customs of the Indians of that province was the task entrusted to me. By necessity it resulted in a picture in which general impressions were combined in a standardized whole. Individual variations within the group had to be neglected. They were not considered as relevant. Furthermore, they can not be obtained by these methods, for they require long-continued personal relations between the observer and members of the group which he wishes to study.

It will perhaps be best to discuss the problems that confront the investigator by taking up physical anthropology, linguistics and culture separately because the crucial questions appear partly in different forms.

---

[1] Read before the American Ethnological Society, May 13, 1942.

In physical anthropology it is possible to define generalized groups adequately, provided we confine ourselves to the comparison of such groups in which the characteristic traits of every individual of the one group are distinct from those of the other, as for instance Bushmen and North Europeans, although we must remember that there are other traits in regard to which the two groups are not fundamentally distinct.

The attempts to define closely related populations in which individuals of the same form are not exclusively found in the one group, or to define single traits that are found in the various groups that are being compared present peculiar difficulties. In all these cases differences between the groups can be expressed only by statistical methods, that is, by determining the frequency with which the various forms occur in each group; but this is not the way in which our minds work. We are impressed by those forms which occur most commonly and combine these forms in one individual, the type. It is easy to show that such a "type" is a construct that has no reality. When, for instance, Professor Sargent constructed the ideal type of the Harvard student by having a sculptor make a figure of a youth whose body measurements corresponded to all the measurements obtained as averages of all the Harvard students, he would have been unable to find any individual strictly corresponding to that type. Supposing he had excluded all those who differed very much from his standard and included only those who were near the most frequent forms so that only the middle half of the series were included, and if furthermore ten independent features had been considered, he would probably have found among 1024 individuals just one who corresponded to his ideal type. In other words the type is a subjective construct. Whether it has an objective reality must be determined by special investigations.

It must also be remembered that types described by averages are not of such character that the differences between two types can be expressed by addition or subtraction. The differences between two averages may be the same, but the variants may be such that in one case not a single measure of the one group would appear in the other, or it may be that both groups have many measures in common, and the measure of difference can not be obtained by subtraction, but only by an evaluation of the significance of the number of cases the two series have in common. The numerical values are not additive.

Another consideration must be borne in mind. When a type is described, previous impressions and preconceived notions influence the description of what we see. A person who has studied a Negro population will see the lips and noses of Indians as narrow, while one whose experience has been with Whites will describe them as broad, even if both observers used the same printed standard pictures as types. In an experiment made by Goring, the foreheads of criminals were described as low, because this was expected, while the actual measurements showed that the description was faulty. All this is equally true of anatomical, physiological and psychological traits.

There is another form of mental reaction to the variability found in a population. The forms deviating most strongly from those of most frequent occurrence are readily considered as separate units, to be excluded from the type. In this manner two or more contrasting types may be established, the middle, most frequent form being considered the result of mixture of the extreme forms, either due to interbreeding or to simple mechanical mixture of the extremes. Wherever pairs of contrasting terms are used this tendency may be suspected. Long-headed and short-headed, tall and short, pyknic and leptosome, extravert and introvert are primarily terminological conventions expressing extremes of a variable form. Their designation as types does not show that they should be considered as distinct elements in a population. An example of this kind is the description of Indian types by an experienced anthropologist who described one group of Indians as composed of a number of types of other tribes whom he had previously investigated and whose forms had impressed themselves upon his mind. The study of extreme forms may bring to light correlations between features that may be obscured in the general mass, such as relations between bodily form and function; but it can not decide whether such relation is due to an inner relation controlled by biological conditions, to mixture of distinct variable forms or to other causes. As in other cases, a statistical statement of numerical distribution may give us a clearly defined problem, the answer to which must be sought in the domain of other sciences. When we find that the size of the body of Europeans and Americans has increased during the last century we have to look for an explanation not in statistics, but in the physiology of growth as affected by sociological or other conditions and by possible changes in the hereditary composition of populations; or when the birth rate of a population changes, the social changes, age distribution and so on that bring about the statistical result have to be investigated.

It can not be emphasized too strongly that it is a fundamental logical error to identify the construct type and the individual, to ascribe all the characteristics of the type to the individual, as well as to mistake a terminological classification for a reality. Such conclusions are scientifically unsound. What is worse, they have a disastrous effect upon our lives. It is clear that the whole Nazi anthropological theory is built up on these misconceptions, on the assumption that members of what is called arbitrarily a racial unit—actually a population—must have individually certain traits in common which conform to the construct type; all this notwithstanding the stress laid upon the hereditary differences in family lines.

The concept of a pure race implies that all individuals constituting the "race" must be genetically alike. The only pure races that we know are purebred domestic animals and cultivated plants and these are purest only in regard to those traits that can be bred pure and that have been selected for pure breeding. The variability of the whole race is low in regard to the selected features and all the family lines are very much alike. The question, in how far fraternities in highly inbred human societies are alike and in how far family lines may be alike in such a community has never been adequately studied. From what we know at the present time we may say that even in highly inbred communities a high degree of variance of family lines as well as of members of fraternities persists, so that the identification of an individual as a significant sample of the group is impossible. The larger the area inhabited by the social group under consideration—generally a nation is meant—the less can any individual be considered as representative of the group, the less can we speak of the "type" of a nation.

There is another very fundamental problem in physical anthropology that has not received adequate attention. A local type is generally considered as stable. Racial heredity means that the typical distribution of forms of one generation will be repeated in the following generation. It has been recognized that differential birthrate, mortality and migration may modify the frequency of various types, but insufficient stress has been laid on the question in how far the children of parents of a given form may differ for physiological reasons from their parents, in other words in how far external conditions may modify the type. We know that lower organisms are susceptible to such changes, but there is still considerable reluctance to accept this problem as one of major importance.

Let us turn from the field of physical anthropology to that of cultural anthropology. In earlier years the attention of students was primarily directed to the problem of the general development of culture, to the discovery of evolutionary stages of culture and to the investigation of historical events that shaped cultural development. The results of these studies will always retain their importance for an account of the history of culture. Archeology, the study of distribution of similar cultural forms, the occurrence of isolated inventions or ideas in regions without apparent historical connection furnish data necessary for the solution of these problems. Except in so far as technical improvement of methods of research is concerned there is little to be said that is new. The importance of continuing this work, of collecting new data in unexplored regions should, however, be emphasized. The interest in new lines of inquiry that has developed during the past twenty or thirty years should not induce us to slight this indispensable field of work.

The description of a type of culture brings up the question of the meaning of the term type in a form somewhat different from the one it has in physical anthropology. As in the morphological description of bodily forms we find in some groups traits which are common to one group and never occur in another one—like the differences between the pigmentation of North Europeans and Negroes—so we find in cultural groups characteristics that differentiate one group fundamentally from another. Such traits are a common language, principles of family organization, motor habits, food and sleeping habits and the like. In all these, individual variations, if they occur at all, are insignificant. Unlike the common anatomical characteristics the traits here referred to are not biologically determined. They are either automatically determined by subconscious, involuntary imitation, or deviations from the norm are so intensely frowned upon by the community that conformity is brought about by coercion.

For this reason the impressionistically derived concept of typical cultural behavior has a much higher degree of reality than that of a physical type. In a simple tribe all individuals speak the same language. They have the same kinds of industries, obtain and use food and shelter in the same way. Groups of the same descent, strictly comparable in bodily form, may differ fundamentally in cultural form. The pattern of culture has greater reality than the biological types because the cultural pattern exerts its influence equally upon every individual, while biological descent produces individuals of different qualities.

Nevertheless, we must recognize that individual variations in behavior exist, dependent upon personality and individual experience. The conditions under which most ethnological work is carried on make it difficult to observe individual variations of behavior, and little material is available for a study of this subject.

One of the characteristic traits of modern anthropology is the emphasis laid on the relation between individual and culture, from two points of view, the shaping of individual behavior by the culture in which the individual lives, and the modification that culture undergoes by the behavior of the individual. The latter is obviously needed for an understanding of the dynamics of cultural changes.

Before speaking on this subject some remarks are necessary on the problems presented by attempts to describe and analyze a culture.

One of the serious difficulties that has never been adequately dealt with is the lack of a precise understanding of the concepts with which alien cultures are operating. These must be obtained from a detailed study of the semantics of the language of the people whose culture we wish to study and this can be obtained only when we have the fullest data that allow us to determine the meaning of the expressions used. Words like "good" and "bad," for instance, have no content unless we know what is good and what is bad. Does "good" cover the ideas of useful, right and beautiful, or is it confined to the concept of useful? Our knowledge of the semantics of primitive languages is wholly inadequate, and still, without it, we can not understand the world in which they live. On the whole our dictionaries are exceedingly inaccurate, even in the translations of material objects or of actions performed with or on material objects. In some languages our term "to break" is not the same concept when applied to long, round or flat objects, although always done by pressure. To sing is not the same, if the song is without words or with words, a dance song, love song or sacred song. "To love" may emphasize the ideas of value, of friendship, or of sexual love and may include the concept of pity. Accuracy of semantic value is particularly demanded in all discussions of religious subjects on account of the vagueness of many of these concepts. Thus it is of prime importance to know that in Bantu languages the being that is generally translated as "God" belongs to the class of inanimate things and can not be conceived as a human or living being. The long discussions about mana and animism might have been avoided, if the semantic value of the terms had been clearly understood. The same may be said in regard to the term soul, which has no equivalent in any primitive language that I know. Life, will power, personality, the memory image of a person, may all be considered as partial equivalents of what we call soul. For a correct understanding of what the speaker has in mind we must know the exact semantic value of the term he uses. I believe that a strict insistence on a better knowledge on the semantic values of words is necessary for a correct interpretation of the thoughts expressed in language.

The methodological problem here touched upon is closely related to that of the classification of forms of primitive life. In natural sciences we are accustomed to demand a classification of phenomena expressed in a concise and unambiguous terminology. The same term should have the same meaning everywhere. We should like to see the same in anthropology. As long as we do not overstep the limits of one culture we are able to classify its features in a clear and definite terminology. We know what we mean by the terms family, state, government, etc. As soon as we overstep the limits of one culture we do not know in how far these may correspond to equivalent concepts. If we choose to apply our classification to alien cultures we may combine forms that do not belong together and separate what belongs together. The very rigidity of definition may lead to a misunderstanding of the essential problems involved. Goldenweiser, in his discussion of totemism, has demonstrated the error to which the definition of the term totemism has led. As explained before, the discussion of the meaning of the concept "soul" can not be based on the assumption that the classification based on our concept can be transferred to an alien culture. When the idea of a soul is that of a tangible object it would have to be grouped with the tendency to classify qualities as substances—such as sickness, success in hunting or gambling—which may stay with a person or leave him. If it is our serious purpose to understand the thoughts of a people the whole analysis of experience must be based on their concepts, not ours.

Let us turn now to a consideration of the relation between the individual and the social medium in which he lives. We may distinguish between the generalized drives expressed in sex-relations, parental relations, relations to other members of the group, etc., which are the subject of a general social psychology; and our particular problem, the interaction between individual and society in different types of cultures. The subject is so recent that a critical examination of the various methods that are being tried is much needed.

Notwithstanding the compelling force of social behavior there is obviously a considerable variation in individual reaction to given standards. As said before, the impressionistically derived typical form of behavior must not be confused with the actual individual behavior which is not identical with the assumed norm. The few available life histories of individuals in primitive societies who changed the political, religious or economic lives of their tribe fellows illustrate the importance of the deviating behavior of individuals.

(To be concluded)

RUNNING RECORDS

By Dr. ALFRED W. FRANCIS

WOODBURY, N. J.

CONSIDERABLE popular interest has developed in running records especially as a result of the recent visit to this country of the Swedish runner, Gunder Haegg, with his seven world's records. There seems to be inadequate means of correlation of records with distance; or more specifically to determine which of two records at different distances is the better. According to newspaper reports the runner himself can not choose among his own records.

It is obvious that a runner can maintain a higher speed for a short run than for a longer distance, but the relation between these speeds and distances is complex. The proper correlation is by a curve through a few of the best records, the others all falling more or less below it, since no record could be better than perfect.

A logical plot is that of average speed in meters per second against the logarithm of the distance as in Fig. 1. The use of the logarithm permits plotting of a wide range of distances without undue crowding at the left end. The curve drawn, with dotted portions at each end, is the plot of the equation,

$$(\log D - 1.5)(V - 3.2) = 6.081$$

which is a hyperbola with a vertical asymptote at 1.5 and a horizontal one at 3.2m/sec. The former is simply equivalent to using a unit of 31.6m in measuring the distance. The latter has a real physical significance, being for a "perfect runner" the "dog trot" velocity. This can be defined as the speed which he could maintain indefinitely without tiring (if it were not for lack of sleep, nourishment, etc.). He can maintain a slightly higher average speed for a finite long distance, or a considerably higher speed for a short distance, either effort producing temporarily complete exhaustion.

The records for less than 400 meters fall below the hyperbolic curve because other factors prevent a runner from attaining such a speed which would exhaust him in those distances. A tangent to the curve is drawn through the record for 220 yards. The records beyond one hour fall below the dotted curve because such races are seldom run under ideal conditions of course and weather; and because other forms of tiring, such as lack of nourishment, enter in. A straight line is drawn through the points for one hour and the marathon. The normal tiring for the large mid-portion of the plot is probably mostly a function of the oxygen concentration in the blood.

The scale of Fig. 1 is too small to permit accurate comparison of different records. This is accomplished in Fig. 2 in which the ordinate is the left-hand side of the equation.

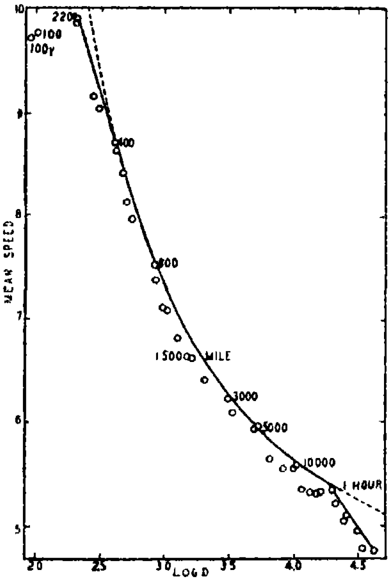


FIG. 1

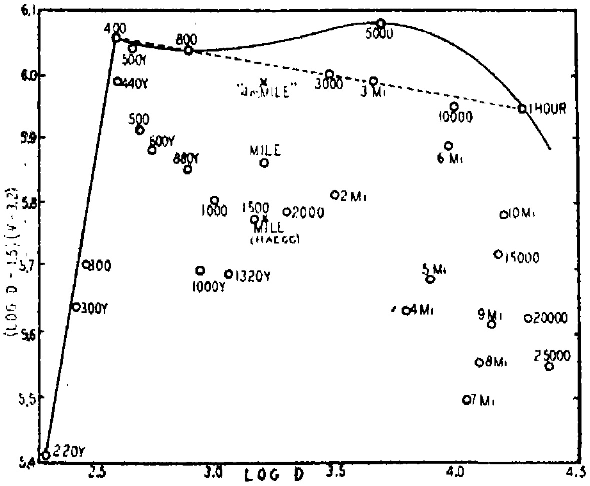


FIG. 2

The record for 5,000 meters is clearly superior to most of the other records. In fact, if it were five seconds slower, the straight dotted line, which nearly passes through seven other points, would correlate the best records nicely. By readjusting the constants of the equation the 400-meter record (which has been run twice) and either the 800-meter record or that for one hour (but not both) could be placed in a horizontal line with the 5,000-meter point, all other records being inferior. This is not done, however, because the choice between the 800 meter and one hour would be arbitrary; and because any new record above the line would require a recalculation with distortion of the whole plot. It is believed that the plot as shown gives a fair comparison between the records. Tentatively a smooth S curve is drawn through the four records mentioned, and is considered to represent the present limit of human speed.

The plot shows that four of Haegg's seven records, the 1,500 and 2,000 meters, his one mile and the two mile, are practically equivalent. The 3,000 meters and three mile are much better, but inferior to his 5,000-meter record. The new mile record by Arne Andersson in Sweden of 4:02.6 is closer to the curve; but even the hypothetical "four minute mile" falls short, and is therefore an imminent possibility.

A straight line is drawn between the 400-meter point and that for 220 yards, showing that those for 300 yards and 300 meters are inferior. The break at 400 meters is of course too sharp, but the abrupt drop is due to the fact that races shorter than 400 meters are not completely exhausting.

The records used in the calculations are those given in the New York World Almanac for 1943, whether officially accepted as world's records or not. Two other records are included, the new mile record made on July 1, 1943, and the 500-yard record of 54.4s. by Borican on June 13, 1940. Table I gives the records for the more usual distances with the products plotted in Fig. 2, and the calculated records corresponding to the curve of Fig. 2. Calculated times for other distances can be found readily by interpolation. Any actual time for a race can be compared with the calculated world's record on a percentage basis, either time for the same distance or, what is more sound theoretically but less convenient, relative distance in the same time; since that represents the relative accomplishment of an inferior runner as compared with that of a "perfect" runner in the same time.

TABLE I

WORLD'S BEST RUNNING RECORDS

Distance	Product*	Time computed	Time actual	Per cent.
100 yd	....	....	9.4s	
100 m	....	....	10.2s	
200 m	5.33	20.16s	20.3s	99.3
220 yd	5.39	20.3s	20.3s	100.0
400 m	6.057	46.0s	46.0s	100.0
440 yd	6.043	46.34s	46.4s	99.87
800 m	6.041	1m 46.6s	1m 46.6s	100.0
880 yd	5.860	1m 47.33s	1m 49.2s	98.26
1,000 yd	5.697	2m 4.7s	2m 8.8s	96.82
1,500 m	5.771	3m 40.4s	3m 45.8s‡	97.61
1 mile	5.860	3m 58.7s	4m 2.6s	98.19
2,000 m	5.788	5m 4.8s	5m 11.8s	97.66
3,000 m	6.000	7m 58.6s	8m 1.2s	99.46
2 miles	5.815	8m 37.2s	8m 47.8s	98.00
3 miles	5.993	13m 26.6s	13m 32.2s	99.31
5,000 m	6.081	13m 58.2s	13m 58.2s	100.0
5 miles	5.687	23m 26.5s	24m 6.2s	97.25
10,000 m	5.950	29m 39.8s	29m 52.3s	99.30
10 miles	5.784	49m 35.0s	50m 15.0s	98.67
19,210 m	5.946	One hour	One hour	100.0

* $(\log D - 1.5)(V - 3.2)$ D in meters, V in meters/sec.

‡ Since this paper was written, Andersson has run 1,500m in 3m 45s.

OBITUARY

LEWELLYS F. BARKER

DR. LEWELLYS F. BARKER, emeritus professor of medicine of the Johns Hopkins University and visiting physician to the Johns Hopkins Hospital, died on July 13 at the age of 75 in his home at 208 Stratford Road, Baltimore. His death brought to a close a long and active career in which he had attained great eminence as a physician and teacher.

Dr. Barker was born in Norwich, Ontario, Canada, on September 16, 1867. His father, James F. Barker, and his mother, Sarah Jane Taylor Barker, were members of the Society of Friends and thus Dr. Barker was brought up as a Quaker. He attended Pickering College from 1881 to 1884 and in 1890 received the degree of bachelor of medicine from the University of Toronto. After graduation he served as an interne in the Toronto General Hospital, and having determined that the Johns Hopkins Hospital was the institution in which he wished to continue his medical studies, he came to Baltimore, and was appointed assistant resident physician by Dr. Osler. This marked the beginning of Dr. Barker's distinguished services to the Johns Hopkins University and Hospital.

During these early and busy years he worked in close association with Osler, Welch and Mall, and it was not long before it was realized that this young assistant possessed a mind of unusual quality and capacity. Dr. Franklin P. Mall, the professor of anatomy, was one of the first to give expression to this feeling and in 1894 selected Dr. Barker to fill the position of associate in his department; and in 1897, at the age of 30, Dr. Barker was made associate professor of anatomy. Under Mall's influence, Dr. Barker became absorbed in a study of the nervous system. This resulted in his first important and extensive contribution to medicine which took the form of a book entitled "The Nervous System and its Constituent Neurones."

A trip abroad to work in Germany with von Fry, Flechsig and His was soon followed by a noteworthy distinction, for in 1900 he was invited to take the chair of anatomy at the University of Chicago. Previous to his departure from Baltimore, however, there had been an opportunity to work in the pathological department at the Johns Hopkins University, and to make two important expeditions, in company with Dr. Simon Flexner; one to the Philippines on the Johns Hopkins Medical Commission, and the second to San Francisco on a commission sent by the Government to determine the existence or non-existence of bubonic plague in that city.

In 1903 Dr. Barker married Miss Lillian Haines Halsey, and later when they made their home in Baltimore, their house became a center to which innumerable friends from home and abroad were welcomed with the greatest hospitality.

While Dr. Barker was professor of anatomy at the University of Chicago, he published an article on the whole-time teaching of clinical subjects. This paper attracted some attention and when Dr. Osler resigned the chair of medicine at the Johns Hopkins University in 1905 to go to Oxford, Dr. Barker was selected to fill this post. It was not, however, possible at that time, to place the department on a full-time basis.

The appointment was a somewhat unconventional one, for Dr. Barker had had little practical experience in clinical medicine. Nevertheless, he returned to Baltimore equipped in other respects in an unusual manner to develop along progressive lines the excellent medical clinic which already existed, for he not only had experience and training in one of the preclinical sciences, but had spent a year working with Friedrick Müller in Munich and with Abderhalden in Emil Fischer's laboratory in Berlin. Endowed with remarkable intellectual qualities, a gift for teaching and unusual executive ability, Dr. Barker enlarged the facilities for investigation, and with much foresight developed the first medical clinic in the country in which well-equipped laboratories for research in chemistry, in physiology and in infectious diseases and immunity formed an integral part of the department. This elaborate extension of the arrangement which then existed was an innovation and an important contribution.

In his practice, he soon came to appreciate the need of emphasizing special examinations, which were rapidly being made available through new techniques, for obtaining information concerning the diseased state of his patients. In the course of these intensive studies, attention was directed not only to the various physical abnormalities, but to the hereditary traits, the emotional reactions and the mental characteristics of the individual; and in order to accomplish this successfully, it was desirable that a small group of physicians, surgeons and specialists should work in close cooperation. Only when the data, obtained in this manner, were analyzed, correlated and coordinated, could a comprehensive diagnosis be arrived at, and what Dr. Barker termed a correspondingly "multidimensional" therapy instituted. It is not surprising that he should have been particularly attracted to a study of the anatomical and functional disturbances of the nervous system, and that first, having laid stress upon the personality of the patient, he should later lay emphasis upon the individual as a complicated and indivisible whole. These were principles which dominated his practise, and which brought him phenomenal success. His knowledge led many groups to seek his advice, not only concerning matters of physical well-being, but involving problems of social welfare.

His interests grew in number and widened in scope and when it became financially possible through the generosity of the Rockefeller Foundation for the Johns Hopkins University to place some of the clinical departments on a full-time basis, Dr. Barker found it impossible, on many accounts, to accept the headship of the department of medicine on this basis. He remained, however, an active and brilliant member of the staff for the remainder of his life, acting as a member of the medical board of the hospital, of which he was chairman for many years, and conducting clinics, the last series of which he completed only a few weeks before his death.

His quick and retentive mind, his wide and remarkably varied interests, his systematic methods of intensive study and concentrated reading, resulted inevitably in an accumulation of knowledge which was almost encyclopedic. This was reflected in his brilliant clinics and lectures, in his addresses and in his numerous articles and treatises which touched almost every phase of medicine. His last book, published scarcely a year before his death, was an autobiography entitled, "Time and the Physician."

He was a member of a great number of medical and scientific societies, and acted as president of many, including The National Committee for Mental Hygiene (1909–1918), the Association of American Physicians (1913), the American Neurological Association (1916), the Southern Medical Association (1919), the Association for the Study of Internal Secretions (1919) and the Medical and Chirurgical Faculty of Maryland (1923). He received the honorary degree of doctor of laws from Queens University, Canada, in 1908; from McGill University in 1911 and from the University of Glasgow in 1930.

Dr. Barker was a conspicuous figure in American medicine. His somewhat stately gracious manner, his height, his white hair and, above all, his long delicately formed hands impressed every one who came in contact with him. There have been few physicians in this country who were more learned in the various branches of medical knowledge, more widely versed in the affairs of man or more interested in the human being than Dr. Barker.

WARFIELD T. LONGCOPE

THE JOHNS HOPKINS HOSPITAL

RECENT DEATHS

DR. ROSCOE RAYMOND HYDE, professor of immunology and director of the laboratories of immunology and filterable viruses of the School of Hygiene and Public Health of the Johns Hopkins University, died on September 15 at the age of fifty-nine years.

DR. BERT CUNNINGHAM, professor of biology at Duke University, died on September 27 at the age of sixty years.

DR. J. WILLARD HERSHEY, head of the department of chemistry of McPherson College, Kansas, known for his work on rare gases, died on September 27 at the age of sixty-seven years.

STEWART H. BURNHAM, who retired recently after serving for more than twenty years as assistant curator of the herbarium of the department of botany of Cornell University, died on September 25. He was seventy-two years old.

DR. ARTHUR A. TICKNOR, divisional chemist for the Calco Chemical Company of Bound Brook, N. J., a subsidiary of the American Cyanamid Company, died by suicide on September 26. He was fifty years old.

DR. GEORGE BACHARACH, assistant professor of chemistry at Brooklyn College, died on September 20, at the age of fifty-five years.

SCIENTIFIC EVENTS

AIRCRAFT PRODUCTION IN GREAT BRITAIN

THE Select Committee on British National Expenditure, in a report on Aircraft Production issued recently, states, according to *The Times*, London, that the aeronautical industry in Britain is suffering from an acute shortage of scientific and technical men. It is stated that there are not enough adequately qualified men available to maintain the industry at the proper level of efficiency. This shortage applies also in the whole field of aeronautical research, including the official establishments, and it is said to have been clear for some time that there is more work than can be done by the existing personnel. The report continues:

> Special measures are therefore necessary. Men of high academic, scientific or technical attainments should not be allowed to be absorbed in the fighting services, where, even when they are employed in technical jobs, their qualifications are often much higher than is needed. More pre- and post-graduate courses in aeronautics are needed at the universities, especially in view of the fact that facilities for training which were available in the industry in peace-time are now used for training R.A.F. personnel. The committee recommends that the appropriate departments should investigate the facilities available for training research workers, aeronautical engineers and other technicians in order to determine what action is necessary to meet requirements.
>
> There is a similar shortage of adequately qualified staffs in all grades of management. The enormous expansion of the industry has entailed the up-grading of large numbers of men with relatively little experience, and it is freely admitted by managements that they have had to promote many men whom they would not normally so promote. Little appears to have been done to remedy the deficiency. In the case of foremen the situation has been worsened by the fact that there is frequently reluctance to accept promotion. In a few cases, the existence of high piece-rate earnings may partly explain this reluctance, but the more general reason is undoubtedly simple unwillingness to accept responsibility. This is not unnatural when it is remembered that relatively few workmen are of long standing in this industry. To remedy these deficiencies the committee recommends that courses should be provided to train foremen for higher grades, and that more use should be made in the Ministry of Labor's courses in foremanship.

The report points out that one of the most disturbing features in regard to the supply of labor for the industry is the high rate of wastage. In the present general shortage of labor it is necessary for firms to engage persons who for one reason or another are not ideally suited for the work. The committee considers that the rate of wastage disclosed is greater than it should be, and that action should be taken by the Ministries of Labor and Aircraft Production to reduce it.

OPHTHALMOLOGICAL RESEARCH AT THE UNIVERSITY OF OXFORD

THE University of Oxford is planning the establishment of a department for ophthalmological research, the activities of which would include research, teaching and the treatment of patients. The Ophthalmological Research Endowment Committee is asking for help in raising £250,000 to build, equip and endow the research laboratories of a department of ophthalmology at the university. Contributions received during the war will be invested in Government securities. The treasurer of the Ophthalmological Research Endowment Fund, Old Clarendon Building, Oxford, will receive contributions. Expenses of the appeal are being met by the generosity of the National Institute for the Blind. *The Times*, London, reports that

> The facilities available for such work are considered wholly inadequate, and the university is appealing for funds towards the establishment of research premises in connection with the Oxford Eye Hospital, the rebuilding of which will be begun at the end of the war; the provision of salaries for full-time and part-time research workers, teachers and technicians engaged in the new department; and the defraying of the working costs of researches which would have for their aim the prevention of blindness, the improved treatment of eye disease and the promotion of a higher standard of visual function throughout the country.
>
> Under the proposed regional scheme of the Joint Hospitals Board, the Oxford Eye Hospital will become the chief regional center (covering the counties of Oxford, Buckingham and Berkshire) for ophthalmological work and teaching. For this the present hospital is inadequate, and is to be rebuilt, the necessary funds being raised by a separate appeal from local sources.
>
> One of the problems which the proposed department at Oxford would examine would be that of discovering the safest anti-bacterial drugs for ophthalmological purposes. The extreme delicacy of the eye is the governing consideration, as all the usual antiseptics are poisons, and further investigation will need contributions not only from ophthalmology, but bacteriology, mycology and chemistry. The most promising substance found so far is penicillin, the development of which is largely the result of work done in an Oxford laboratory.
>
> The Oxford scheme, which will be generally welcomed, will form an important contribution towards the great national effort that is being made to abate the toll and suffering and economic wastage due to loss of sight and defective vision. Statistics prove that, while failure of vision is a hazard common to all, the risk falls increasingly on those who are in middle and later life. In 1941 out of a total blind population of 74,000 in England and Wales, 63,000 were persons over 40 years old.

REHABILITATION CLINICS AT THE NEW YORK HOSPITAL

A PSYCHIATRIC rehabilitation program which it is hoped may point the way toward reclamation of the estimated 80,000 New York City men thus far rejected or discharged from military service because of mental illness has been initiated by the Payne Whitney Psychiatric Clinic of the New York Hospital.

Recognizing that the thousands of men who have proved unsuitable material for the Army, Navy and other services because of psychoneurosis constitute a wartime emergency problem that will exist and grow, even after the war, the hospital has established a special out-patient clinic that is already functioning and the full resources of the clinic will be devoted to patients' rehabilitation. The integration of psychiatric treatment with the psychological testing, retraining and employment resources of an actual community is to be emphasized in the program.

Originators of the plan are Dr. Thomas A. C. Rennie, attending psychiatrist at the clinic and associate professor of psychiatry at Cornell University Medical College, who will direct the program, and Mrs. Melly Simon, chief of psychiatric social service. Dr. Rennie was recently named director of the Division of Rehabilitation of the National Committee on Mental Hygiene. Basic funds to start the clinic have been granted by the Commonwealth Fund.

The clinic is staffed by New York Hospital psychiatrists, psychoanalysts and social workers, all of whom are serving on a voluntary basis, and it is expected that by mid-October fifteen or more such volunteer psychiatrists will be actively at work. In addition to the New York Hospital volunteer staff, other psychiatrists in the city have signified their willingness to participate in the same kind of project.

Among social service agencies having evidenced their interest and willingness to cooperate with the program are the New York City Committee on Mental Hygiene, the National Committee on Mental Hygiene, the Social Security Board, the U. S. Employment Service, the Vocational Adjustment Bureau, the American Rehabilitation Committee, the Community Service Society and the Y.M.C.A. Arrangements have also been made for the referral of cases to the clinic by the State Selective Service Board.

According to Dr. Rennie, the clinic will fulfil two main functions: one, as an actual treatment center for men in need of rehabilitation and, two, as a fact-finding agency to determine the extent of the problem, the amount of help necessary for rehabilitation, the nature of psychiatric disabilities and what percentage of the patients treated may eventually be re-employed.

NEW FLORAS PUBLISHED BY THE NEW YORK BOTANICAL GARDEN AND THE UTAH STATE COLLEGE

BETWEEN the State Agricultural College of Utah and the New York Botanical Garden an agreement was signed in July by which the two institutions will cooperate in the field work for and the preparation and publishing of two important floras: (1) A Manual for the State of Utah and (2) A Flora (illustrated) of the Intermountain Region.

Both of these projects had been started by Dr. Bassett Maguire during the years he spent at the State College in Utah. Now, as curator at the New York Botanical Garden, he will be enabled to continue his work of collecting and writing on the plants of these regions, while his successor in Utah, Professor A. H. Holmgren, will aid in the work. Three more summers of exploration are planned: 1944 to complete the work in the State of Utah, 1945 and 1946 to be spent in western Nevada and eastern Oregon and Washington, and 1947 to be devoted to a final round-up of the entire intermountain area.

The two institutions are to share equally in all collections, and while the writing of the proposed floras becomes jointly the responsibility of both, the publication of the Manual for Utah is to be largely the responsibility of the Utah State Agricultural College, while the publication of the Flora of the Intermountain Region is to be mainly the responsiblity of the New York Botanical Garden. This region, which has never been adequately or completely treated floristically, is the only major physiographic area of the country that has not heretofore come under the influence of the Botanical Garden, and it is the region perhaps least known botanically.

A VISITING PROFESSOR TO CHINA

DR. GEORGE B. CRESSEY, as already reported in SCIENCE, has been appointed a visiting professor in China by the Department of State, and concurrently will serve as representative in China of the National Academy of Sciences. He is leaving for Chungking this month and will return to the United States next summer.

The appointment is a part of the program of the department of cultural relations, and is designed to strengthen the ties between the United States and China. Professor Cressey will visit and lecture at various Chinese universities and research centers in order to bring the greetings of American scientists to their Chinese colleagues. Most Chinese universities have been obliged to take refuge in the interior and are seriously in need of contact with the outside world. Although it is impossible to send books and apparatus, the Department of State has arranged to forward microfilm copies of professional publications from the United States.

Professor Cressey has been chairman of the department of geology and geography at Syracuse University since 1931, and is on leave for this assignment. Prior to 1931 he taught at the University of Shanghai. He is the author of "China's Geographic Foundations" and a new volume entitled "Asia's Lands and Peoples." Professor Cressey is also chairman of the Committee on Asiatic Geography of the National Research Council, and is one of the recognized authorities in his field. He served as consultant to the Chinese Government in 1934 and to the Soviet Government in 1937.

THE AUTUMN MEETING OF THE AMERICAN PHILOSOPHICAL SOCIETY

THE autumn general meeting of the American Philosophical Society will be held on November 19 and 20, beginning at 10 A.M. on Friday, November 19. For guests invited by the society and for members from a distance the society will, as usual, meet the regular hotel charges for rooms during the period of the meeting and for such meals as are not otherwise provided for by the society. Those desiring such accommodations should notify the society as soon as possible.

On Friday morning, November 19, there will be papers chiefly by recipients of grants from the research funds. The afternoon and Saturday morning sessions will be devoted to a "Symposium on the Organization, Direction and Support of Research." On Friday evening, President James B. Conant, of Harvard University, will speak on "The Advancement of Learning in the United States in the Post-War World." This will be followed by a reception. Before the open session on Saturday morning, there will be an executive session of the members of the society.

L. P. EISENHART,
Executive Officer

SCIENTIFIC NOTES AND NEWS

THE Manly Memorial Medal of the Society of Automotive Engineers was presented at the Los Angeles meeting to John Dolza and Harry C. Karcher, of the Allison Division, Indianapolis, of the General Motors Company, in recognition of their work on "Correlation of Ground and Altitude Performance of Oil Systems." The award was established in 1928 to honor Charles M. Manly, designer of the forerunner of modern radial airplane engines.

DR. EDWIN B. HART, professor of agricultural chemistry at the University of Wisconsin, was a special guest and the main speaker at a dinner given by the division of agricultural and food chemistry of the American Chemical Society in connection with the one hundred and sixth annual meeting, which was held at Pittsburgh from September 6 to 10.

DR. ROBERT M. GATES, president of the Air Preheater Corporation, New York, has been elected president of the American Society of Mechanical Engineers. He succeeds Harold W. Coes, of New York. The joint meeting with the Engineering Institute of Canada opened at Toronto for three days on September 30.

EDMUND L. DUNN, of Boston, president of the New England Fish Exchange, was elected president of the Atlantic States Marine Fisheries Commission at the annual meeting recently held at Philadelphia.

THE Western Reserve University Chapter of the Society of Sigma Xi has elected the following officers for 1943: J. C. Gray, *President*; Normand L. Hoerr, *Vice-president*; R. F. Hanzal, *Treasurer*, and Helen A. Hunscher, *Secretary*.

The election of Dr. Gardner Murphy, chairman of the department of psychology of the College of the City of New York, as president of the American Psychological Association was announced on September 2 at the fifty-first annual meeting of the society at Evanston, Ill. Lieutenant-Commander C. M. Louttit, of the Navy Department, and Professor Donald Marquis, of Yale University, were added to the council of directors. Professor Willard C. Olson, of the University of Michigan, was re-elected secretary for a three-year period, and Professor Willard L. Valentine, of Northwestern University, was continued as treasurer and business-manager of publications. Financial support again was voted for the Office of Psychological Personnel at Washington, D. C. It was decided that recommendations on the reorganization of psychology from the Intersociety Constitutional Convention should be referred to members for a mail ballot.

Colonel Albert S. Dabney, M. C., U. S. Army, who will retire on November 30 as assistant commandant of the Medical Field Service School at Carlisle Barracks, Pa., has been appointed assistant dean of the School of Medicine of the University of Pittsburgh. The *Journal* of the American Medical Association states that Colonel Guy B. Denit, M. C., U. S. Army, who recently returned from a six-months tour of duty as chief surgeon of a base section in the African theater of operations, will temporarily replace Colonel Dabney as assistant commandant at the Medical Field Service School. A ceremonial retreat parade was held on August 31 in honor of Colonel Dabney, and Brigadier General Addison D. Davis, commanding general of Carlisle Barracks, commended him for his loyal and efficient services. A veteran of two world wars and a medical officer for twenty-seven years, Colonel Dabney had been at Carlisle Barracks since June 27, 1939, first as director of the medical department equipment laboratory and since January 10, 1942, as assistant commandant. Prior to this, he had been executive officer in the Surgeon General's Office at Washington, D. C.

Dr. William O. Hotchkiss, president of the Rensselaer Polytechnic Institute, retired on October 1 with the title emeritus. Dr. Matthew A. Hunter, professor and head of the department of metallurgical engineering, has been made dean of the faculty, and Dr. Ray Palmer Baker, assistant director of the institute, has become dean of students.

Dr. Louis S. Goodman, assistant professor of pharmacology at the Yale University School of Medicine, has been appointed professor of pharmacology and physiology and chairman of the department of the College of Medicine of the University of Vermont.

Dr. Harry C. Solomon, clinical professor of psychiatry, has been appointed professor of psychiatry at the Harvard Medical School and medical director of the Boston Psychopathic Hospital, succeeding the late Dr. C. Macfie Campbell. Dr. Solomon graduated at Harvard in 1914 and has been a member of the faculty since 1915.

Robert L. Cushing, of the department of agronomy of the University of Nebraska, who has also been associated with the Bureau of Plant Industry and has had charge of the grain sorghum investigations for the Nebraska region, has been appointed assistant professor of plant breeding at Cornell University.

Dr. Howard Reynolds, of the University of Arkansas, has been named assistant professor of bacteriology at Iowa State College. In addition, he will be in charge of research on food bacteriology for the Iowa Agricultural Experiment Station.

Dr. Jay McLean, of the Memorial Hospital for Cancer, New York City, has been appointed associate professor of surgical research at the Ohio State University, where he will continue his work on heparin.

Dr. Charles E. Clark, professor at the Bradley Polytechnic Institute, has been named associate professor of mathematics at Emory University.

A. W. Ling, chief agricultural advisory officer of the University of Bristol, England, has been appointed principal of Seale-Hayne Agricultural College, Newton Abbot.

Dr. Lester Krampitz, of the Rockefeller Institute for Medical Research, has been appointed a research associate at Iowa State College. He will take charge of a study of penicillin to be carried out by the Industrial Science Research Institute.

Dr. J. Osborn Fuller has been appointed assistant professor of geology at West Virginia University, not, as incorrectly reported in a recent issue of Science, at the University of Virginia.

Dr. Albert L. Elder, associate professor of chemistry at Syracuse University, now head consultant to the Chemical Divisions of the War Production Board, has been named special assistant in coordinating penicillin production to Fred J. Stock, chief of the section of drugs.

Dr. Aristid V. Grosse has been released from the Rubber Director's Office of the War Production Board to become director of research for the Houdry Laboratories of the Catalytic Development Corporation at Marcus Hook, Pa. Dr. Edward R. Gilliland, of the War Production Board, has been appointed an assistant rubber director in charge of research and development.

DR. KENNETH MORGAREIDGE has been appointed head of the Biological Assay Laboratories of the National Oil Products Company. Dr. John R. Foy has been made assistant head of the same laboratories.

DR. MARSHALL C. HECK, since 1941 assistant professor of animal husbandry at the Massachusetts State College, has resigned to become meat specialist for the National Livestock and Meat Board.

DR. CHARLES W. RIPPIE, formerly associated with the Shell Oil Company and Monsanto Chemical Company, has been appointed supervisor of the technical service at Painesville, Ohio, of the Diamond Alkali Company, Pittsburgh.

DR. WILBERT M. CHAPMAN, curator of the department of ichthyology of the California Academy of Sciences, has leave of absence to enable him to serve as senior fisheries specialist for the Office of Economic Warfare.

DR. ALEXANDER G. RUTHVEN, president of the University of Michigan, has been invited by the British Government to spend several weeks in England to make a study of war and post-war education. The project is concerned chiefly with the development of a program of adult education for Great Britain with emphasis on returning soldiers.

THE botanical and geological expedition to the Alaska Military Highway (see SCIENCE, 97: 574, 1943), led by Dr. Hugh M. Raup, of the Arnold Arboretum, returned to Boston on September 17. Leaving Dawson Creek on June 8, the party traversed the highway from Dawson Creek to Whitehorse and return. Notes and botanical collections representing approximately 2,500 field numbers were made, principally in four areas, with miscellaneous material from many other points along the road.

PROFESSORS L. R. LAUDON and H. T. U. Smith, of the department of geology of the University of Kansas, spent the summer in the Northwest Territories of Canada, serving as field geologist and aero-geologist, respectively, on the Canol project of Imperial Oil, Ltd.

DR. H. P. FROES, director of the School of Tropical Medicine of the University of Bahia, Brazil, recently spoke before meetings of students and members of the profession at Baylor Medical School, Houston, and the Medical School of the University of Texas, Galveston. Dr. Froes described the broad sanitary measures being undertaken in Brazil to reduce the menace of the spread of tropical diseases, particularly through increased airplane traffic.

THE American Physical Society will meet at Northwestern University on November 12 and 13. For this meeting a symposium on the physics of rubber and other high polymers is planned. It is expected that Drs. P. Debye, J. H. Dillon, P. H. Emmett, S. D. Gehman, H. M. James, H. Mark, M. Mooney, H. Sack, W. B. Wiegand and L. A. Wood will be among those represented on the program. There will also be the usual sessions for contributed papers, of which announcement will be sent to members of the society about October 25.

THE forty-sixth annual meeting of the American Ceramic Society, Inc., will be held at the Hotel William Penn, Pittsburgh, Pa., from April 2 to 5, 1944. Technical programs and information on post-war ceramic industrial welfare essentials are planned.

COLUMBIA UNIVERSITY opened its one hundred and ninetieth academic year on September 29. Due to the war many new courses are being offered. In the engineering department, fuel technology, synthetic plastics, chemical engineering research, communications electronics and manufacturing processes have been introduced. New language courses include elementary Russian and Japanese.

DR. EDWARD S. ROSS, assistant curator of the department of entomology of the California Academy of Sciences, San Francisco, now in the Sanitary Corps of the Army, and Lieutenant Radcliff Roberts, also of the Sanitary Corps, have published a "Mosquito Atlas of the World."

THE School of Medicine of the University of Texas announces the publication of *Texas Reports on Biology and Medicine*, a quarterly scientific periodical available without charge to the libraries of medical institutions throughout the world.

MEMBERS of the entomological department of the University of Texas plan an expedition to southern Mexico and the desert country near Monterrey with the object of adding to the university's collection of gnats and flies which is said to be the largest in the world. These insects are being used in research on genetics conducted at the university with the aid of a $35,000 grant from the Rockefeller Foundation.

A SPECIAL correspondent from the French Frontier writes to *The Times*, London, as follows: "Since the outbreak of war the deaths in France have exceeded the births by nearly 500,000 and the net decrease in the population for 1942 alone is 93,625, according to the latest official statistical bulletin. The chief cause of the rapid shrinkage of the population is now tuberculosis aggravated by malnutrition, particularly an insufficiency of fats. A second contributory cause is the high infant death-rate, which has risen from 63 per 1,000 in 1939 to 91 in 1940, 75 in 1941 and 70 in 1942. That undernourishment is the basic cause is indicated by the fact that mortality from all causes is far greater in the larger towns than in the country.

DISCUSSION

THE CENSUS BUREAU AND THE GREAT LAKES AREA SITUATION

THIS is a brief reply to the defense of the Census Bureau, by Geographers Batschelet and Proudfoot, in a recent issue of SCIENCE, regarding current inaccuracies in the total area figures for the United States and the Great Lakes States.

We tried unsuccessfully for four years (not quite ten!) to track down the responsibility for these errors, with one federal bureau after another squirming out of it. For fourteen months of this period, we had the assurance of Director Austin that the Census Bureau would clearly show the correct total area figures for the Great Lakes States and the United States in the Census of 1940. News of the reversal of this promise was not conveyed to us until the bureau's official release of April 11, 1941, arrived. The bureau then said it was too late and too expensive to change, and retired to a last-line defense by disclaiming legal status for their area figures. At this point we pursued the librarian of the Congress of the United States to the extent of one letter; and it was that official who laid the responsibility for official area figures squarely at the door of the Census authorities.

The omission of 61,000 square miles from the total area of the United States can not be lightly dismissed as meaning nothing to any one other than Michigan and Great Lakes chauvinists. This is an American domain comparable in area to England, Scotland, Portugal, Austria, Belgium, Bulgaria, Denmark, Greece, Guatemala or Holland—a greater portion of American-owned earth's surface than occupied by any one of twenty-seven states of the Union.

Michigan's Great Lakes water area, say the Census Bureau defenders, has never been denied her. They then proceed to give columns of reasons for excluding Great Lakes area from the total area of Michigan and the other Great Lakes States. This Great Lakes water area is denied in total area figures in all current reference books, which take their facts from the Census Report.

Of course the Census Bureau knows about the Great Lakes areas of the Great Lakes States. All figures in the tabulation that accompanied our original article were gleaned, here and there, from footnotes and subsidiary tables in the 1940 Census Report. The bureau's fault is that its way of hiding the figures (so that, they state, even we missed them), is misleading and the cause of widespread inaccuracies.

The clause in the proposed new Michigan constitution will specify merely that the Great Lakes area of Michigan shall be included in the official total area figure of the state. That will permit the use of more accurate measurements from time to time as these become available.

Difficulty in apportioning Great Lakes water among counties and townships of Great Lakes States is given as a reason for lopping off more than one third of the total area of Michigan and more than a seventh of that of Wisconsin; for short-measuring six other states; and amputating from the United States the area of a good-sized kingdom. This is Procrustean performance, not scientific procedure. Surely the mosaic of statistical interpretations should be fitted to the actual fact, rather than the fact mutilated to facilitate statistics.

The Census Bureau defenders cite practise in regard to various large bodies of water in the world, as arguments to support their method. These seas—most strikingly the Mediterranean and the Baltic—are not at all comparable with the Great Lakes. Significantly they omit Lake Victoria in Africa, Lake Baikal in Siberia and Great Slave, Great Bear and Winnipeg Lakes in Canada, all inland fresh-water bodies as large or larger than Lake Ontario. In these approximately parallel instances, the current practise is to include the water areas in the geographical divisions which possess them or a part of them.

We agree whole-heartedly that it is not the function of the Census Bureau to decide state claims to land or water areas and that it does right to avoid trouble in the matter of coastal water areas to which various states "feel they have a legal claim." But when boundaries are legally established, by treaty, Acts of Congress and decisions of the Supreme Court of the United States, the Census Bureau is bound to respect them, and cease to classify them—for statistical convenience—among boundaries that are nebulous.

It seems necessary to re-emphasize that the international line through the Great Lakes region exists independent of the presence of water. If an earthquake tomorrow should swallow or shift any or all of the Great Lakes, the boundary would still remain exactly where it is to-day.

The Census Bureau's obsessional fear of the political hornet's nest involved in ocean-coastal claims is apparent in the space they devote to that tangled world-situation—which is totally unrelated to the clear division of the Great Lakes waters.

Canada and Ontario view the matter as a simple arithmetical problem—the square measurement of regions within established legal boundaries. Ontario includes its share of the Great Lakes in its total area because this is legally a part of that province. Canada includes this water area in its total area, because Ontario is a legal part of the Dominion. They rest their case convincingly on the Quebec Act of 1774; the Treaty of Paris of 1783; the Constitutional Act and an Order in Council in 1791; the Union Act of 1840; and the British North America Act in 1867.

The Great Lakes region between the international line and the southern shore of the Great Lakes is a part of the United States and should be included in its total area, by virtue of the Treaty of Paris of 1783.

The Great Lakes region between the international line and the Michigan shoreline of the Great Lakes is within the boundaries of and constitutes a part of the State of Michigan, by virtue of the Ordinance of 1787; Act of Congress for the division of Indiana Territory, 1805; Act of Congress, June 15, 1836, admitting Michigan to statehood; and three Supreme Court decisions (270 U. S. Rep., p. 295; 272, p. 398; 297, p. 550–552).

The proposition that title, jurisdiction and proprietorship of the land under the waters of the Great Lakes is in the adjoining states is recognized and established by the following authorities: *Illinois Central Railroad Co.* v. *People of the State of Illinois,* 146 U. S. Rep. 387; *Murphy* v. *Dunham,* 38 Fed. Rep. 503, Eastern District of Michigan, Brown J.; *Bigelow* v. *Nickerson,* 70 Fed. Rep. 113, 7th Circuit Court of Appeals; Attorney General's Opinions, Volume 6, page 172.

The foregoing citations were given us by the Honorable Edward Gearing Kemp, former Assistant U. S. Attorney General, now chief counsel of the Budget Bureau at Washington. This eminent jurist, after reading the entire correspondence with the Federal bureaus, commented that the "old method of reporting water areas is obviously misleading, and in my opinion, inaccurate."

We have no quarrel with the Census Bureau. Their task is vast and tedious and its difficulties too little appreciated. They have gone forward, in many ways, since the time of Gannett, as they say. Nevertheless, their attitude toward this Great Lakes question gives grave room for suspicion that they need a speedier adjustment to this fast-moving world. Why should they, at a time when this continent is leading the earth in countless ways, hark back for precedents to the chaos of old-world geography, where boundaries are about as permanent as the wake that a ship leaves in the water? Above all, why do this in relation to the great transcontinental boundary of North America, the fixity of which marks a new epoch in history, is the envy of the world and a model for the future?

If the Bureau of the Census persists in being concerned exclusively with statistical involvements, and the General Land Office to be interested in nothing but land areas, and the Geological Survey is motivated chiefly by a desire to cooperate with the foregoing agencies, where is the world and its reference books to look for the answer to the simple arithmetical question: What is the total area of the United States and the Great Lakes States? At present, the prevailing inaccuracies are a shadow on the record of the Census Bureau.

CHASE S. OSBORN
STELLANOVA OSBORN

SAULT STE. MARIE, MICH.

SCALE CURVES IN CARTOGRAPHY

IT is well known that a sphere can not be mapped upon a plane with a uniform scale. Various types of maps are faithful with respect to angles or areas or geodesics, but not to all of them. In the Mercator projection, the scale varies from latitude to latitude. In a general conformal map, the scale varies from point to point (and therefore is a function of the latitude and longitude).

However, if the mapping is not conformal (angles not preserved), then the scale necessarily depends not only upon the point but also upon the direction. Hence the situation is essentially non-isotropic.

We define a *scale curve* as a locus along which the scale does not vary. In the conformal (or isotropic) case, we have merely ∞^1 scale curves; whereas in the non-conformal mappings, we have ∞^2 scale curves. In all conformal maps, the scale curves form a simple family; but in all non-conformal maps, the scale curves form a doubly-infinite family.

Among the famous non-conformal maps are azimuth equidistant projection, azimuth equi-area projection and the various gnomic and orthographic projections. For each of these, the scale varies in a complicated way not usually described geometrically but only analytically. A faithful graphical representation would involve the construction of the double infinity of scale curves. We study these curves (all of which are complicated) in detail. We prove that no mapping of the sphere exists with ∞^2 straight scale curves. *A new class of surfaces is discovered with straight scales.*

The two most famous conformal maps of the sphere are the Mercator projection (1560) and the stereographic projection, essentially known to Ptolemy (150 A.D.). In the former case, the ∞^1 scale curves are parallel straight lines, and in the latter case, they are concentric circles. We prove that these are the only maps where the single infinity of scale curves forms an isothermal family (connected with the Laplace equation). They are also the only maps where the scale curves are parallel. If we demand that the scale curves (in a conformal map) be straight lines, the unique solution is the Mercator projection. On the other hand, if the scale curves are circles, the only solution is stereographic projection.

In the most general conformal mapping of a sphere upon the plane, the scale function is never harmonic; but it may be a function of a harmonic function. We prove that this phenomenon occurs only in the stereographic and Mercator projections.

The double infinity of scale curves which we find for the general non-conformal mapping of a sphere (or any surface) has special geometric properties. If we consider the curves of the family passing through a fixed point, the locus of centers of curvature is necessarily a *cubic curve*. In a particular case this locus becomes a straight line, that is, the scale curves form a velocity family. This can happen only for a certain class of surfaces, which will be described in detail elsewhere.

EDWARD KASNER
JOHN DE CICCO

COLUMBIA UNIVERSITY
ILLINOIS INSTITUTE OF TECHNOLOGY

VITAMIN C FROM EVERGREENS

IN the interesting and informative letter by B. Shishkin to the American Association of Scientific Workers published in a recent issue of SCIENCE[1] there is a description of the search by Soviet botanists for a plentiful supply of vitamin C.

> Quite recently it was discovered that needles of ordinary pine trees contain large quantities of vitamin C. . . . During the long siege of Leningrad lack of vitamin C made itself particularly felt, and the decoction made from pine needles played an important role in the prevention of scurvy.

This is an interesting example of the rediscovery by modern scientists of a fact known to a primitive civilization. Francis Parkman,[2] in "Pioneers of France in the New World," written in 1865, describes the trials of Cartier and his men during the winter encampment of 1535–36.

> A malignant scurvy broke out among them. Man after man went down before the hideous disease, till twenty-five were dead, and only three or four were left in health. The sound were too few to attend the sick, and the wretched sufferers lay in helpless despair, dreaming of the sun and the vines of France. The ground, hard as flint, defied their feeble efforts, and, unable to bury their dead, they hid them in snow-drifts. . . .
>
> Cartier, walking one day near the river met an Indian, who not long before had been prostrate like many of his fellows with the scurvy, but who now, to all appearance, was in high health and spirits. What agency had wrought this marvellous recovery? According to the Indian, it was a certain evergreen, called *ameda*, (a spruce, or, more probably, an arbor-vitae), of which a decoction of the leaves was sovereign against the disease. The experiment was tried. The sick men drank copiously of the healing draught,—so copiously indeed that in six days they drank a tree as large as a French oak. Thus vigorously assailed, the distemper relaxed its hold, and health and hope began to revisit the hapless company.

WOLCOTT B. DUNHAM

DIVISION OF MICROBIOLOGY,
SQUIBB INSTITUTE FOR MEDICAL RESEARCH,
NEW BRUNSWICK, N. J.

SPANS TWO CONTINENTS

As a result of extensive studies I have discovered that Hokan, an American Indian language spoken in California and other parts of North America, extends to South America. Hokan previously had been found to extend only as far south as the Subtiaba language of the Pacific slope of Nicaragua, Central America. Evidence for this discovery has been put in the form of a report to the Bureau of American Ethnology which demonstrates the affinity of Hokan to Quechua, an American Indian language spoken in Peru and adjacent parts. This affinity was discovered to comprise completely the phonetics and morphology, and to the identity with Hokan of 258 Quechua words. Quechua wi-qe, tear, is found for example to mean eye-water, and to be composed of wi-, eye, compare Pomo ui, eye, and -qe, water, compare Pomo **-xa**, water.

JOHN P. HARRINGTON

BUREAU OF AMERICAN ETHNOLOGY

SCIENTIFIC BOOKS

STRUCTURAL GEOLOGY

Structural Geology. By MARLAND P. BILLINGS. 473 pp. 336 text figures. 19 plates. New York: Prentice-Hall, Inc. 1942. $4.50.

THIS carefully designed and executed new text devotes sixteen chapters (331 pages) to structural geology, grouped as follows (chapter numbers in parentheses): Mechanical principles (2); Folds (Description, 3; Field study and representation, 4; mechanics and causes, 5); Failure by rupture (6); Joints (7); Faults (Description and classification, 8; criteria for recognition, 9; thrust faults, 10; gravity or normal faults, 11); Secondary foliation and lineation (12); Unconformities (13); Salt Domes (14); Plutons (15); Granite tectonics (16); Extrusive igneous rocks (17).

---

[1] B. Shishkin, SCIENCE, 97: 354, 1943.

[2] Francis Parkman, "Pioneers of France in the New World." Little, Brown and Co., nineteenth edition, p. 194, 1882.

Two additional chapters give a concise introduction to two borderland fields of rapidly growing importance to Structural Geology—Structural Petrology (23 pages) and Geophysical Methods (41 pages).

As this table of contents shows, primary structures of sediments are dealt with only incidentally in connection with the "determination of top of beds" in the chapter on field study and representation of folds. The compaction of sediments and the resulting structures are given twenty lines and a sequence of three purely diagrammatic text figures. The plains' type of folds is neither mentioned by name nor distinguished adequately in word or illustration. The scanty treatment of structural features which dominate the relatively undisturbed regions must disappoint the petroleum geologist. But this is more than offset by the refreshingly new and comprehensive treatment of plutonic and volcanic rock structures (71 pages) which had been correspondingly neglected in some textbooks. This must please the ore geologist.

There is no chapter on the problems of isostasy, epirogenesis and orogenesis and speculations concerning their ultimate causes, subjects which have always been popular among young students and have furnished topics for innumerable "bull sessions." The whole subject has been avoided deliberately by the author because it "can be intelligently studied only by geologists with a broad background in many fields of geology." This is eminently true. Nothing, in fact, tends to discredit geological thinking more in the minds of gifted students and endangers the mental processes of all more than the recital of spectacular hypotheses without a thorough analysis of all the elements of observation and reasoning from which they have grown.

To the reviewer it seems, nevertheless, that the broad facts concerning the structural patterns of continents and oceans, the distribution of the major zones of folding and faulting, of earthquake and volcanic activity deserve a place in such a text-book, divorced from all speculation concerning causes. One good reason for their omission suggests itself: Our undergraduates can not be expected to possess any knowledge of place geography or to own an adequate atlas.

While this particular thought may not have influenced the author, concern for the undergraduate mind is evident throughout the book. It is deliberately and effectively designed for instruction at the undergraduate level in United States colleges. Correspondingly, no knowledge of the basic sciences is assumed. For the college student in these United States can not be counted upon to possess any, as those responsible for the training of technicians in the Armed Forces have found out. Moreover he must not be made painfully aware of his deficiency, and he is not apt to have learned as yet to make it up on his own initiative. Accordingly, such physical concepts and knowledge as are needed in structural geology have to be explained explicitly. The chapter on mechanical principles, for instance, devotes three full pages to the definition of "force" and to the "composition and resolution of forces."

Under the circumstances this is as it should be. With so low a start in basic knowledge, one can not, of course, go far in the attempts to explain structural geological phenomena in terms of the modern physics of materials. This the author has recognized.

But there is an enormous contrast between the physics required for the understanding of the second chapter and the last one. The student who needs the elementary explanations of the former simply can not grasp the latter. This constitutes no blemish of the book. It merely means that the last chapter (perhaps the last two chapters) should be fully assigned only to students with sufficient preparation.

The undergraduate in the United States is also accustomed to receive his mental food meticulously prepared in the most digestible form. The author has, accordingly, taken great pains to write as simply as possible, to reduce all illustrations to the simplest form, and to avoid, as far as possible, or reduce to a minimum all critical discussions of matters that are as yet little understood.

To the reviewer this process seems to have been carried farther than is necessary. Structural geology is but in its youth. Its uncertainties are a constant challenge to active minds. Somehow that side of it does not crop out as much as the reviewer should like to see it. Similarly, the preponderance of generalized diagrams, over three fourths of all text figures, tends to give a final and abstract air to the matters discussed.

The same characteristics, on the other hand, enable the instructor to introduce concrete illustrations and discussions from his own experience without largely duplicating the contents of the chapters. It is evident that the book was cast deliberately in that form with that end in view. The book is, thus, an efficient tool for college instruction and not primarily a book for self-study. This is shown also by the collection of practical exercises which conclude the book. These occupy 55 pages and constitute an integral and eminently valuable part of the work.

Turning to individual items, the reviewer is glad to see the words "pitch" and "plunge" given fixed status as technical terms for angles between lines in space; the former, to designate the angle between the line of strike of an inclined plane and another line in the same plane; the latter, for the angle between the horizontal and an inclined line, measured in a vertical plane. Thus, striations "pitch" with reference to the line of strike of a fault, and "plunge" with reference to sea level.

The reviewer is also glad to see a false statement, "commonly made in geological literature," sharply corrected, having once, in good faith, helped to spread it in print, *viz.*, that the angle of shear is greater than 45 degrees in "ductile" materials.

In other respects, however, the discussion of failure by rupture is open to criticism. If the angle of sheer is "always less than 45 degrees" in the direction of greatest shortening (p. 102) it is not feasible to interpret systems of rectangular joints as shear planes (pp. 126 and 127) or to say that the shear fractures are "approximately parallel" to the circular sections of the strain ellipsoid which form a strongly obtuse angle in the direction of the greatest shortening (p. 109).

In general, the strain ellipsoid is given the lip service usual among American geologists, but it is not introduced where it belongs first of all: in the explanation of the results of laboratory compression and tension tests. For such cases an obviously megascopic "imaginary sphere" is introduced inside the cylinder or square prism that is undergoing compression (p. 101). In both objects it is said to be deformed into an oblate spheroid.

This is, of course, not true in the case of the square prism. The "imaginary sphere" does not explain why the fractures form a cone in one case and a four-sided pyramid in the other. The absence of the concept of the strain-ellipsoid from so basic a discussion shows that it is not introduced at all in the truly valid sense.

Actually in this text, as in most writings of geologists who use it, the word "strain ellipsoid" stands for a two-dimensional figure of an ellipse, which is placed on the picture of a geologic structure in such a way that its axes point respectively in the directions of greatest (relative) shortening and lengthening. Into this figure diagonal lines are drawn to suit the writer's imagined needs: now intersecting at right angles (Fig. 109, p. 127) now at highly obtuse angles which face in the direction of greatest shortening, both strictly contrary to all laboratory evidence, and never, not once, in the only direction justified by the facts set forth at the start.

No wonder this devise is praised as "exceedingly useful if it is employed with discrimination." This matter obviously needs revision in the second edition.

In the discussion of the larger aspects of rupturing, of thrusts and faults, the rôle that plastic deformation, solid flow, plays in rock deformation seems to the reviewer too much neglected. Thrust sheets and fault blocks are more than lumps of inert matter that are set in motion by forces wholly outside of them. They are invariably parts of larger rock bodies every particle of which is in active upward, outward, or sideward movement, the planes of rupture representing discontinuities in the rate of movement. Seen in that light, the author's general use of the term "gravity fault" appears downright indefensible. Failure to give it the attention it deserves accounts for the wholly inadequate treatment of the structures that characterize the folding in the Swiss Alps. It also explains why the author has given over 90 lines and 8 text figures to the discussion of drag folds, while he refers in only four and a half lines to the type of minor folding that abounds in crystalline limestones and schists.

Further recitations of differences in bias or emphasis between the reviewer and author would tend to obscure the basic fact concerning this book: It is a text-book of high merit, written in simple language, easy to read (being printed in large type), forthright in its approach to the concrete matters of terminology and basic principles, methods and technique in structural geology which are indispensable as a foundation for practical work.

Walter H. Bucher

Columbia University

SPECIAL ARTICLES

BIOLOGICAL EFFECTS OF A TOXIC AND A SENSITIZING SUBSTANCE ISOLATED FROM PARAFFIN OIL EXTRACT OF DEAD TUBERCLE BACILLI[1]

It is a well-known and remarkable fact that killed tubercle bacilli retain many important properties characteristic of the living organism. The nature of the lesions which develop at the site of inoculation and the sensitization to old tuberculin (an almost infallible test of infection) which it confers on animals, has always shown clearly that the dead bacilli have the same specificity of action as that of living ones.

The effects of dead tubercle bacilli become quite comparable to those of living organisms with regard to lesions and sensitization if the dead bacilli are suspended in paraffin oil instead of saline solution. The experiments of Hagan and Levine,[2] Opie and Freund,[3] Couland,[4] Saenz[5] and Noel Rist[6] established clearly

---

[1] This study was carried on under a grant from the Josiah Macy Junior Foundation.

[2] Hagan and Levine, *Jour. Am. Vet. Med. Asn.*, 8: 728, 1932.

[3] E. Opie and J. Freund, *Jour. Exp. Med.*, 66: 761, 1937.

[4] Couland, *Rev. de le Tub.*, p. 850, 1934.

[5] A. Saenz, *Revue d'immunologie*, p. 590, 1937.

that the inoculation of paraffin oil suspensions of heat-killed tubercle bacilli produce a sensitization to old tuberculin (O.T.) at least as intense as that given by living virulent bacilli (and much more intense than that given by the same amount of dead bacilli in saline solution). The oil suspensions also provoked the appearance of lesions far from its site of inoculation, whereas suspension in saline gives merely local lesions. All workers agree that pure paraffin oil alone does not produce these effects.

In spite of achieving such results, approaching more and more closely to those induced by living bacilli, workers in the field were still of the opinion that the whole organism was necessary to produce the effects. This opinion was strengthened by the numerous unsuccessful efforts to sensitize normal animals to O.T. with substances extracted from tubercle bacilli.

In attempting to answer the question as to the nature of the mechanism by which paraffin oil enhances the effects of dead bacilli, it occurred to me that it might consist of the removal of substances from the bacilli by the oil. In such a case one should be able to find an active principle in oil which had been in contact with the dried dead (killed by autoclave) bacilli.

Such oil was subjected to prolonged centrifugation, which separated it from the suspended bacilli. The resulting oil differed from the pure oil in viscosity, absorption spectra and specific fluorescence. Moreover, biological controls, after centrifugation at 80,000 r.p.m. for 24 hours, confirmed the fact that this oil was free of bacilli.

I have been able to show that this oil extract contains an active antigen which precipitates with tuberculous rabbit serum. The inoculation of this oil stimulated the formation of antibodies in rabbits and produced a definite sensitization to O.T. in guinea pigs.[7] For the first time, therefore, it was possible to sensitize normal animals to O.T. without using the whole dead or living organism.

In attempting to find the material responsible for this sensitization, a toxic substance was extracted from the oil. A precipitate was first obtained from the oil with the aid of dioxane. This precipitate, P, was submitted to extractions with many organic solvents.

Among these, the dried chloroform extract, inoculated into guinea pigs intraperitoneally in paraffin oil, was found to be very toxic, 2 gamma, the smallest dose tried, being sufficient to produce lesions in the lungs and usually killing the animal.[8] The biological results were supervised by Dr. Alfred Boquet, head of the department of tuberculosis at the Paris Pasteur Institute.

The toxic substance proved to be acid-fast and highly birefringent. It shows beautiful colorations in polarized light. Microanalysis of the toxic substance showed it to be free of nitrogen and phosphorus.[9] Hydrolysis with 10 per cent. potassium hydroxide in alcohol separates it into sugars and an acid alcohol which appears to be very similar to the mycolic acid isolated by J. R. Anderson.[10] But neither mycolic acid nor these sugars alone have shown such biological toxicity. It is possible that the toxicity of this polysaccharide is due to an impurity of a protein nature not discernible in the microanalysis. In this case, such an impurity must be active in amounts as small as 0.01 gamma.

The work which had been carried on in Paris (Institut de Biologie Physico-Chimique) was interrupted in June, 1940, by the war. It was resumed at Cornell University Medical College (Dr. Morton Kahn's laboratories) in the spring of 1942. The nature of the sensitizing substance contained in the oil was still unknown as well as the amount necessary to produce sensitization.

From 8 grams of dried human tubercle bacilli (all that was at first available) of the strain H_{37} (single cell, Dr. Morton Kahn) which is of a low virulence, it was not possible to extract the toxic substance in significant amounts. However, from this material, it was found possible to extract a substance which sensitized normal guinea pigs to P.P.D. and also O.T. with a single 1/10 mg injection. The inoculations were made intraperitoneally, the substance being suspended in paraffin oil. It was later possible to sensitize normal animals with the same amount of substance suspended in saline. All these results were supervised by Dr. Morton Kahn.

It was interesting to determine the relative proportion of toxic and sensitizing substances in two different strains of different virulence. Cultures were made with the strains H_{37} (Dr. Kahn) and a strain PB_{15} of a higher virulence isolated by Dr. Florence Seibert on Corper's medium and cultivated by us on Long's medium. It was found that the precipitate, P, from PB_{15} was richer in toxic substance and poorer in sensitizing substance than the precipitate from H_{37}.

Of the animals (8 out of 10) which revealed sensitization to P.P.D. and O.T. five weeks after receiving a single injection of 0.1 of mgr of the sensitizing substance, 5 remained sensitized 10 months later. Three of them were sacrificed to assure us that they were not tuberculous. The two others, as well as three who were no longer sensitized, and five controls then re-

---

[6] Noel Rist, "L'Allergie conferée par le bacille morts." These de Paris, 1938.

[7] Nine Choucroun, *Compt. Rend., Acad. des Sci.*, 208: 1757, 1939.

[8] *Ibid.*, 210: 511, 1940.

[9] *Ibid.*, June, 1940.

[10] R. G. Anderson, *Jour. Biol. Chem.*, 85: 339, 1929.

ceived (February 9) H_{37} live bacilli. All the animals died before May except the two which were still sensitized. These are still living and in good health. This experiment was only an indication that the sensitizing substance may act as a protective one. Further experiments, now under way, involving 46 animals, appear to confirm this impression.

The sensitizing substance may, therefore, be able, if separated from the toxic material which accompanies it in the whole bacilli, to protect animals against tuberculosis.

Nine Choucroun
Department of Public Health and
Preventive Medicine,
Cornell University Medical College

AN INOCULATED PENICILLIN DRESSING

Concentrated and purified penicillin are not available to civilians except in extreme circumstances. For intravenous administration it is desirable to use the purest and most potent product obtainable. There are conditions, however, in which it is possible to use advantageously penicillin of less potency. Wounds, furunculosis, sinus infections, gonorrhea and other infections of the skin or mucous membranes might be so treated.

In order that patients may have the benefits of penicillin treatment not otherwise available we have explored some of the possibilities of the use of the crude product.

The Florey or Oxford Unit is defined as "the amount of penicillin which, when completely dissolved in 50 ml of meat extract broth, just inhibits completely the growth of the test strain of *Staphylococcus aureus*."[1] Thus a solution containing one unit per cc represents a bacteriostatic agent against the staphylococcus diluted 50 times. The average production from Czapek's synthetic medium is about 4 units.[2]

Since, in the accounts of the therapeutic use of penicillin, the continuous exposure of the infecting organism to the penicillin is stressed, it seemed possible to us that in surface infections the substance might be produced in contact with the lesion. A dressing 5 cm × 5 cm composed of eight layers of gauze was placed in a Petri dish and saturated with a medium containing 1 per cent. yeast extract, 2 per cent. dextrose, 2 per cent. corn starch and 2 per cent. glycerine. This was autoclaved and inoculated with penicillium. After two days at room temperature 1 cc of sterile human plasma was allowed to flush underneath the dressing to simulate as well as possible its application to an open wound. At intervals, shown in the protocol below, the Petri dish was tipped so that the small amount of liquid would drain away from the gauze. This was titrated by the ring test and dilution method. Fresh plasma was substituted under the dressing for that withdrawn. (See Table 1.)

TABLE 1

Titration of Penicillin Produced on Inoculated Dressing

Days after inoculation	Diameter of ring test	Units of ring test	Dilution of complete inhibition	Units by dilution method
3	30 mm	5 +	.....	...
4	22	.75	.....	...
6	24	1.0	1 : 200	4
7	..	...	1 : 200	4
8	21	.75	.....	...
10	10	.25	1 : 10	.20
3 Control washed with salt sol.	25	1.5	.....	...

It is impossible to say that these *in vitro* tests represent the exact conditions which would result in the application of the dressing to a lesion, yet the tests demonstrate that a fair amount of penicillin is produced over a period of 4 or 5 days and a bacteriostatic condition would be maintained at the point of contact with the lesion.

Clinical application of the penicillium inoculated gauze dressings and the crude liquid penicillin was made, employing patients who had not been relieved by other acceptable forms of therapy.

One patient had an acute osteomyelitis and periostitis of the right humerus of two weeks' duration. A previous wide incision had been made over the site of the lesion and sulfonamides were prescribed without relief. An inoculated gauze dressing was planted over the wound. Within three hours there was less pain, and in ten days the patient was discharged from the hospital clinically well.

Another patient who had a large furuncle on the back of his neck was treated by injecting the crude liquid penicillin into the open crater and by the local application of an inoculated gauze dressing. Three days later the patient was relieved of all discomfort and the wound was granulating.

A third patient had multiple soft tissue abscesses over his lower back and sacral region. This infection has been recurring regularly for three years. The infecting organism was a *Staphylococcus aureus*. His last period of hospitalization under accepted methods of therapy has been of six months' duration. Crude liquid penicillin was injected into the abscesses and their sinuses and penicillin inoculated gauze dressings were placed over the larger abscesses. This patient is remarkably improved and is still under treatment.

Two other cases of chronic osteomyelitis and periostitis of the femur are being treated with the crude liquid penicillin and the inoculated penicillin gauze dressings. These patients are clinically improved, but final evaluation will await a subsequent report.

---

[1] H. W. Florey and M. A. Jennings, *Brit. Jour. Exp. Path.*, 23: 120, 1942.

[2] E. P. Abraham and E. Chain, *Brit. Jour. Exp. Path.*, 23: 103, 1942.

Our laboratory observations and limited clinical experience indicate that this method of treating acute and chronic pyogenic surface infections may hold promise of a possible addition to our therapeutic armamentarium.

George H. Robinson
Jas. E. Wallace
Allegheny General Hospital,
Pittsburgh, Pa.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN AUTOMATIC FLOW SWITCH FOR WATER-COOLED APPARATUS

It is often desirable in the continuous operation of a water-cooled apparatus, such as a diffusion pump, to have an automatic device to stop the heating should the flow of cooling water drop appreciably or even stop. A simple and easily constructed device for the protection of such apparatus is described.

The switch was made from 8 mm pyrex tubing as shown in Fig. 1. Two sealed-in leads of tungsten wire were used for contacts. The two U-tubes are approximately twenty cm in height, but the dimensions are, of course, not critical. Two U-tubes in series are necessary to prevent ordinary chlorinated tap-water from coming in contact with the leads. The size of the orifice is 2 to 3 mm and must be varied with the flow rate desired. The two U-tubes are partially filled with mercury, with the intervening space filled with either an inert liquid or air. The use of a column of air to connect the two mercury columns renders the switch extremely sensitive to slight pressure changes.

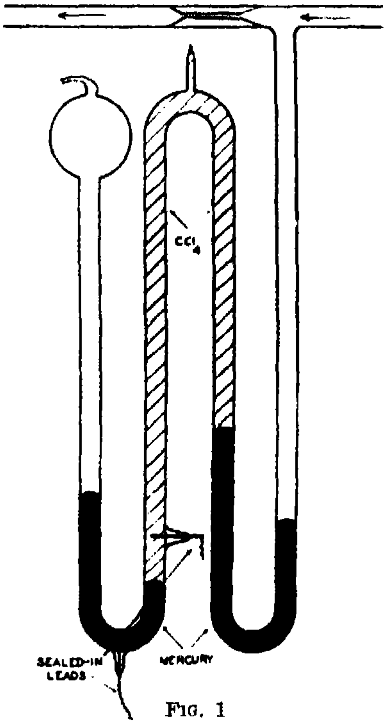


Fig. 1

The switch is inserted in the cold water inlet of the condenser or other water-cooled apparatus, and as long as sufficient cooling water is flowing the mercury in each U-tube stands at different heights. Should the flow of water cease, however, the mercury is restored to the normal level and electrical contact is made between the two sealed-in wires. The switch is connected in series with a normally closed relay to break the heater circuit when the flow of water ceases.

If the uppermost sealed-in lead is built into the opposite arm of the U-tube, the mercury is in contact with the two leads as long as the water is flowing, and in this case the circuit is broken rather than closed by a drop in flow rate of cooling water. Thus, the switch can be constructed so that failure of cooling water supply will either complete or break an electrical circuit, and hence the switch can be used with either a normally closed or normally open relay depending upon which side of the U-tube the contact wire is inserted. If the heater current is reasonably low the switch itself can be used directly in the heater circuit without the use of a relay.

This safety device was developed during an investigation which was supported by a grant from the Abbott Fund of Northwestern University.

Romeo W. Goulet
Chemical Laboratory,
Evanston, Ill.

BOOKS RECEIVED

Haagensen, C. D. and Wyndham E. B. Lloyd. *A Hundred Years of Medicine.* Illustrated. Pp. xii + 444. Sheridan House, Inc. $3.75.

Kells, Lyman M. *Calculus.* Illustrated. Pp. viii + 509. Prentice-Hall, Inc. $3.75.

Morgan, Clifford T. *Physiological Psychology.* Illustrated. Pp. xii + 623. McGraw-Hill Book Company. $4.00.

Robertson, G. Ross. *Laboratory Practice of Organic Chemistry.* Pp. x + 369. Macmillan Company. $2.50.

Smithsonian Institution. Annual Report of the Board of Regents Showing the Operations, Expenditures, and Condition of the Institution for the Year Ended June 30, 1942. Illustrated. Pp. xiii + 421. U. S. Government Printing Office. $1.50.

Snell, Cornelia T. and Foster Dee Snell. *Chemistry Made Easy.* Four Volumes. *The Theory of Inorganic Chemistry. Elements and Compounds in Inorganic Chemistry. The Aliphatic and Aromatic Compounds of Organic Chemistry. Chemicals of Commerce.* Pp. xxx + 1,214. D. Van Nostrand Company, Inc. $7.95.

Strong, Edward K. *Vocational Interests of Men and Women.* Illustrated. Pp. xxix + 746. Stanford University Press. $6.50.

Tannehill, Ivan Ray. *Weather around the World.* Illustrated. Pp. xi + 200. Princeton University Press. $2.50.

Zemansky, Mark W. *Heat and Thermodynamics.* Illustrated. Pp. xiv + 390. McGraw-Hill Book Company. $4.00.

SCIENCE

VOL. 98 FRIDAY, OCTOBER 15, 1943 No. 2546

The Value of the Museum: DR. ROBERT MAYNARD HUTCHINS 331

Recent Anthropology: THE LATE PROFESSOR FRANZ BOAS 334

Obituary:

Deaths and Memorials 337

Scientific Events:

Preference Order for Reagent Chemicals; The Guggenheim Latin American Fellowships; Grant to the National Research Council from the Johnson and Johnson Research Foundation 338

Scientific Notes and News 340

Discussion:

American Standard Letter Symbols for Heat and Thermodynamics: DR. SANFORD A. MOSS. *A Texas Skeleton:* DR. CYRUS N. RAY. *Transliteration of English Names into Russian:* DR. VALENTINA KROTKOV 343

Scientific Books:

Tropical Diseases: DR. THOMAS T. MACKIE. *Statistical Tables:* DR. C. I. BLISS 345

Special Articles:

A Protective Antiserum against Mouse Pneumonitis Virus: MAURICE R. HILLEMAN and DR. F. B. GORDON. *Attempts to Protect against Influenza Virus with Various Sulfonamides, Acridines and Antibiotics:* THE PERSONNEL OF NAVAL LABORATORY RESEARCH UNIT NO. 1 347

Scientific Apparatus and Laboratory Methods:

Diasone. A New and Active Chemotherapeutic Agent: DR. GEORGE W. RAIZISS 350

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

THE VALUE OF THE MUSEUM[1]

By Dr. ROBERT MAYNARD HUTCHINS

PRESIDENT OF THE UNIVERSITY OF CHICAGO

WE meet to-night to celebrate the birthday of one of the great educational and scientific institutions of the world. Through its researches and publications it has advanced the four sciences to which it is devoted. Through its exhibitions and instruction it has enriched the life of the community it serves. The museum can boast that for two generations no child could grow up in Chicago without coming under its influence. We record to-night our gratitude to the founder and his family, to the hundreds of generous citizens associated with them and to the distinguished scholars who have made these contributions to the enlightenment of our city and the world.

As an educational institution Field Museum possesses certain special advantages. It has no football team. It gives no course credits or course examinations and awards no degrees. Its labors are not encumbered by the elaborate apparatus of academic bookkeeping which has resulted in education by the adding machine. The students of the museum come here to learn. They do not ask the museum to help them make friends, get a better job or give them a leg up the social ladder. The students come to the museum from the cradle to the grave. Formal education in schools, colleges and universities is something you finish. It is like the mumps, measles, whooping-cough or chicken-pox. Having had education once you need not, indeed you can not, have it again. You put it behind you with your other juvenile troubles, praise the Lord that it is over at last, and proceed to the really important tasks of life. The museum is free from this regrettable tradition. The museum is seductive. Perhaps because it does not employ compulsion, but woos the learner with artful wiles, it continues to deceive him into educating himself as long as he lives.

---

[1] Address given at the ceremonies marking the fiftieth anniversary of the founding of Field Museum of Natural History, September 15.

The combination of these advantages with the liberal and far-sighted policy of the board of trustees has given the museum a freedom and independence in the prosecution of its work that are enjoyed by few educational institutions. So Colonel Gregg felt able to say in 1939 that the sole purpose of the museum was to pursue knowledge for its own sake. He went on: "Whether its collections are used for the study of industrial scientists who seek to make a profit, by scholars who seek to solve some problem of research, or by casual visitors who seek recreation and enjoyment is not of primary concern to a museum. The only real concern is that the collections be available and that they be used."

The pedagogical significance of the collections is as obvious as it is great. The chief difficulty of any classroom teaching is the absence of three-dimensional reality, and the specialization, mechanization and urbanization of life are making the difficulty more serious every year. It may shortly be as hard to make an American city-dweller understand agriculture and its significance as it would be to discuss the Fiji Islanders with the Eskimos. Other educational institutions deal perforce with books and words. For that constant illustration of the idea by the fact which is indispensable to the communication of any ideas they must rely on the three-dimensional reality which can only be supplied by museums.

Armed with its peculiar advantages the museum goes forth to do battle with its peculiar problems. The first is produced by its origin and history. In 1931 the British Board of Education uttered the following melancholy reflections on the name museum. "Does it not suggest," the board said, "a depressing, decaying institution, the last resting place of travelers' mementos and of fossils which have undeservedly survived from ages long ago? The existing prejudice is deeply rooted in the tough soil of our language and in the popular mind, but it would most surely be overcome if a generation of children were given systematic opportunities of enjoying the treasures of modern museums." By the method recommended by the British Board of Education Field Museum has robbed the word museum of depressing or decaying connotations to such an extent that I am sure a Chicago audience will be surprised to hear that anybody thought it had any. In passing I should add that the facts seem to belie the gloomy attitude of the Board of Education toward the word museum in England. In 1939 a reliable authority stated that new museums had been opened in the British Isles at the rate of one every three weeks for the last ten years. Attendance at British museums has been steadily increasing during the war. By popular demand they remained open during the Battle of England and the blitz.

But the purpose of the second museum established in this country, that of the East India Marine Society at Salem, illustrates the problem that all museums are still trying to solve. The Salem museum was organized in 1799 to be a repository for the curious objects gathered by the ship captains of the town in the lands of the South Pacific, Indian and South Atlantic oceans. Such a museum, which was simply a cooperative curio cabinet, has the same relation to education as the stories of sea captains or the tales with which Othello, who was himself a sea captain, engaged the attention of Desdemona. They are interesting and amusing, and sometimes produce, as in Desdemona's case, sensational results. But they are usually ephemeral and often false—my sea-captain grandfather told me most atrocious lies—and such material, whether it is words or objects, should hardly be central in education. Whatever educational value it once had has now almost wholly disappeared, and its presentation is no longer the special function of a museum. The newspapers, the movies, the magazines and the department stores have long since taken over the job of gratifying the public appetite for the odd, the quaint and the amazing; and they have succeeded to such an extent that the public is largely indifferent to objects recommended to them because of their odd, quaint and amazing characteristics.

This problem is part of the larger problem of the relation between information and knowledge. Facts are indispensable, but they are not enough. Unrelated miscellaneous facts, however odd, quaint or amazing, are not knowledge, in spite of any impression to the contrary given by the Quiz Kids or Information, Please. The characteristic of knowledge is organization, which implies understanding, ordering and interpretation. A heterogeneous collection of facts is not knowledge; a heterogeneous collection of objects is not an educational institution. The art of the museum scientist, which is displayed at the highest pitch in this building, lies in the presentation of objects on an organized plan to convey meaning. For it is not the object that is important; it is the meaning of the object. The educated man is not one whose mind is a waste-basket or even an Encyclopedia Britannica of unrelated facts. He is one who grasps the significance of what he sees. An educational institution is one which helps its students to make these interpretations or at least to learn how to make them.

Education, to deserve the name, must be systematic. For this reason one may be permitted to doubt whether coast-to-coast radio broadcasting can ever deserve the name. It may encourage people to engage in systematic study, and hence be valuable as far as it goes. But since it can not be systematic, either in its presentation or in what the listener does with it, it can not itself be education. The great museums have become systematic expositions of the arts and sciences with which they deal. They promote the comprehension of the facts presented. But the most systematic presentation of material must fail of its purpose if it is not systematically studied. The casual wanderer through the best of all possible museums will not get much education out of it unless he already has a good education in the facts and ideas which the museum is endeavoring to communicate. The casual caller without such education may be stimulated to get one; but he will not be educated by his call.

Therefore the maximum integration of the museum with other educational institutions in the community is the first requisite of its increased educational usefulness. Although the museum is so integrated with the public school system that no child can pass through the system without passing through the museum, the same relations do not obtain between the universities of the area and the museum, either in instruction or in research. The reason is partly the inertia of the universities and partly the small size of the museum staff. Highly valuable relationships do exist; but they are too few and too informal.

The universities are conducting teaching and investigation in the same sciences in which the museum is interested. The research of both groups should be advanced by cooperation between them. The teaching of the universities would gain reality by a more definite, planned exploitation of the museum's resources. The teaching of the museum achieves coherence as it becomes part of a course of study which gives some assurance that the student will begin at the beginning and go through to the end. The integration which the museum has achieved with the curriculum of the public schools should be rapidly extended to the higher levels through integration with the curriculum of the universities. This will require substantial additional funds at the museum to increase the staff so that it may be possible for members of it to participate in university work and give instruction here or on the several campuses to university students. But expenditures to promote cooperation in research and coordination in education are economies in the long run, for they help to get rid of the greatest waste in teaching and investigation, the waste of duplication, and their ultimate effect is to get the most out of every dollar spent for the advancement of learning in the community.

From habits of systematic study developed in their early years the museum may expect to obtain the systematic use of the museum by adults. The education of adults is and must remain the peculiar obligation and opportunity of Field Museum. This is much more important than the task of providing innocent amusement for the citizen's idle hours. The best index to the character of any civilization is the way in which those who have leisure use it. The Greeks said that work was for the sake of leisure. But their word for leisure was the origin of our word for school. They did not mean that work was to get the money to go to the movies or to Palm Beach. They meant that it was to provide the means for study, reflection and the duties of citizenship. And since they used their leisure for these purposes, they became the guides and teachers of all succeeding generations.

To the Greeks the object of life was happiness. Happiness consisted chiefly in the exercise of one's highest powers. And these powers were exercised in study, reflection and active participation in the life of the community. For these objects leisure was required, and one who did not have it could hardly be called human. The Greeks obtained their leisure in a way that does not commend itself to us. They got it through the ownership of slaves. Slaves were not people. But the leading thinkers among the Greeks went farther. They held the view that since leisure was indispensable to a human life, those who must spend all their time in menial, mechanical pursuits which gave them no inclination or opportunity for study, reflection or participation in the affairs of the community were not sufficiently human to be citizens of a good democracy.

In our own day, in our own country, the ideal of the Greeks has been attained. For slaves we have machines. The hours of labor have steadily fallen. The leisure which was the privilege of the few is now the prerogative of all. This process will continue. The concentrated labors of American scientists on military secrets have given an impetus to technology which will become apparent when the war is over. I believe that we are at the beginning rather than the end of the scientific revolution. Technology will continue to supply material goods in greater and greater quantities with a continuous decline in the amount of labor necessary to produce them. In spite of the cost of reconstruction and rehabilitation, in spite of enormous debts and enormous obligations to millions who are without the means of subsistence, the working day and the working week will continue to fall, and the amount of time which the worker will have at his own disposal will continue to rise.

Machines can set men free. But freedom is not an end in itself. It is no good to you unless you know how to use it. If we accept the Greek view that the good life is found through intellectual and moral development and service to the community, then true freedom is that which is devoted to these ends. The kind of civilization we have will depend on whether we can dedicate our increasing leisure to these ends or whether we shall spend it once more, when we can, in driving furiously back and forth on the crowded highways, catching glimpses of the countryside between the billboards. The transformation of the American conception of leisure from time to waste into time to learn is one of the major responsibilities of the museums.

It is not education to make a living that we require, but education to make a life. For many, perhaps most, jobs in industry men can be trained in two or three weeks. As mechanization increases and we become a nation of button-pushers, the time needed to learn how to push the right button at the right moment will shrink still further. When jobs are available the worker can now get and hold one with less experience and skill than at any time in history. The knowledge and background necessary to make a living are approaching the vanishing point. But the difficulties of leading a good life and being a good citizen are greater than ever. And since our education has been largely devoted to vocational training and something called college life, we are unprepared for these difficulties. They place a strain on the intelligence and character of our people that has become almost intolerable. With increasing leisure we do not know what to do with ourselves. With the responsibility of leading the way to a democratic world community, we are unprepared to make the sacrifices required by a thoroughgoing democracy at home and unwilling to face the fact that a democratic world community, which offers the only hope for permanent peace, can not be achieved without the sacrifice of prejudices dear to our hearts—prejudices about foreigners and their goods and prejudices about the participation of foreigners in political decisions affecting our lives. Yet a world organization is on the way. There can be no doubt about that. The swift advance of transportation is making it inevitable. The only question is, what kind of world organization will it be? Will it be a despotism of that power or those powers which can hold down the world by force? If so, it will disintegrate as allies quarrel or as the oppressed and downtrodden gather the strength to rise against their masters. Will it be a democratic world community? If so, the responsibilities of the American educational system assume such proportions that we can only weep at the colossal triviality in which it has been wasting its days.

If every man is to be free, then every man must be educated for freedom. If every part of the world is to join in a democratic world community, then every part of the world must understand every other part. Transportation will not do the job. Faster transportation is just as likely to lead to more frequent and more terrible collisions as to world peace. Any community rests on communication, and communication means understanding. As the college must pass from the country-club stage which it has occupied too long, the museum must change from a curio cabinet into an integrated part of an educational system dedicated to teaching men how to live human lives and how to live them together on a world-wide basis. This is the great educational task of the future. The record of Field Museum in the last half century has laid the foundations of its leadership in the next.

RECENT ANTHROPOLOGY. II

By the late Professor **FRANZ BOAS**

MODERN anthropological literature shows that intimate observations on individual lives are felt to be essential for further progress, and new methods have been devised to obtain the needed information. Some of these methods seem to me of doubtful value. It is obvious that, setting aside laboratory experiment, the only way to obtain the necessary information is through a most intimate and long-continued life with the people and a perfect control of their language. These conditions are rarely attainable, or those who fulfil the practical needs are often in other ways not equipped to obtain the information we seek.

One of the methods used to overcome these difficulties is to induce natives to write or tell autobiographies. The better ones of these give us valuable information in regard to the struggles of everyday life and of the joys and sorrows of the people, but their reliability, beyond very elementary points, is doubtful. They are not facts but memories and memories distorted by the wishes and thoughts of the moment. The interests of the present determine the selection of data and color the interpretation of the past. Goethe called his autobiography Fiction and Truth, and this is true of the autobiographies of elderly persons. It is similar to what happens in telling a tale. Quite recently Lowie has published versions of a Crow tale, told at various times by the same individual, which show remarkable variations in plot and motives. I have published similar records of the same tale, retold by the same informant after an interval of nearly forty years, which show the stability of formal elements and the variability of motives. This is much more intensely the case in records of personal experiences. The same person has told me incidents of his own life at one time as simple, matter-of-fact occurrences, at other times as supernatural experiences. The form given depends upon the state of mind of the recorder at the moment. I do not doubt that this happens often in regard to accounts of early supernatural experiences. Whenever a young man is required to have a supernatural experience, he will be ready to interpret a convenient event in the desired way, and in his memory it will assume ever-increasing importance. In his records personal likes and dislikes may also affect the presentation of events, inclusions or omissions of pertinent data. In short the tricks that memory plays us are too important to allow us to accept autobiographies as reliable, factual data. They are reflections of the facts as expressed in the present mental condition of the informant. Particularly in the case of the North American Indian the fundamental changes of life that have occurred during the past eighty years make it likely that customs that were at one time highly significant have lost or changed their meanings and are now reinterpreted according to the present state of mind of the informant. Autobiographies, on account of the restrictions just mentioned and of the difficulty of assembling a sufficient variety of individual records, are of limited value for the particular purpose for which they are being collected. They are valuable rather as useful material for a study of the perversion of truth brought about by the play of memory with the past. The rest is not much more than an account of customs collected in the usual way.

If we want to understand the individual reactions to cultural patterns we should rather pay attention to the events of daily life; not only to what people are doing but also what they are talking about. Conversations within the family, discussions among friends, gossip of the village offer an inexhaustible source of data showing the reactions of people to customary behavior and illustrating their individual standards. When a younger brother upbraids an elder brother because he is too lazy to provide for the needs of his family, but first apologizes because he dares to criticize an elder brother, light is thrown on the constitution of the family that can not easily be obtained in another way. The approval or disapproval of the behavior of a particular person and the reasons given for it, particularly disagreements in judgment, furnish us with illuminating information on aspects of the individual reactions to culture. Observations of this kind require, of course, much time and particularly adequate knowledge of the spoken language, but they seem to me indispensable for a clear understanding of the relation of the individual to the culture in which he lives. The variety of situations and the number of individuals observed is also much greater than can be obtained by any other method.

Other material may be furnished by folk-tales. Their plots are based explicitly or implicitly on judgments of behavior; therefore they are a fairly safe guide for judging the attitudes of the people for right and wrong, proper and improper behavior. To give an example: The extent to which parents are allowed to punish their children is a frequently exploited problem in the tales of the Northwest coast of America. A chief has the duty to see to it that his son purifies himself preparing for the quest of a vision, but when he strikes his recalcitrant son, so that he runs away, supposedly to commit suicide, the father is expelled by his tribe, presumably because he has caused the death of the chief's successor. In other tales, the reaction against overweening pride or the help given to the poor furnish material that may be compared with actual behavior.

The desire for understanding the dynamics of cultural change has also led to the study of those situations in which actual changes may be observed. This is particularly the case when different cultures come into contact and new adjustments are required. The results of acculturation have been the subject of historical studies. In the spread and development of western civilization from the times of the early Sumerians and Egyptians acculturation plays a most important role. The same is true in eastern Asia. Unfortunately most of the processes of acculturation that happen under our eyes are those of the destruction of simpler culture by the overwhelming force of western civilization. Where an actual amalgamation has occurred, as among Indians in Latin America and among Negro communities in the New World, we see only the results, little of the processes. The readjustments that occur in India, China and Japan in their contact with the western world are probably those in which the effect of conflict of modes of thought, feeling and action can be studied most advantageously. Less violent conflicts occur in the migration of Europeans to other continents and in the consequent formation of new cultural units. I do not think that we are as yet in a position to tell where the scattered data on personal adjustments or maladjustments, of conflicts between generations in a changing culture, of the formations of new forms that eliminate the original conflicts, may lead us and what methods are best adapted to clear up these manifold, complicated phenomena.

During the past decades psychologists and medical men have taken a keen interest in anthropological data and have made the attempt to transfer their methods of research directly to the study of social behavior. It seems to me that this has led to much confused thinking.

The tendency of modern psychology is to reduce observations to quantitative values. Thorndike declared at one time that "whatever exists, exists in some amount and can be measured." This is true if we remember that the term "to measure" is used in a much broader sense than what we ordinarily mean by it. I can measure a rod one foot long and add another foot in length, but I can not add two amounts of intelligence and make it a double intelligence. This is still more true when comparing groups represented by averages. I have tried to explain this in our discussion of anatomical types. We may speak of degrees of difference, but these are not additive and require special definition. This fact has to be borne in mind in all observations on so-called quantitative data of variable mental phenomena. Before using them we must know the significance of our quantitative values.

Another precaution is essential. Psychological observations and conclusions are based essentially on experiences in our own culture. To a lesser extent this is also true of medicine, particularly in regard to psychiatry, which has shown the greatest interest in observations made on primitive people. It is, therefore, of fundamental importance to know in how far it is justifiable to transfer our methods and experiences to groups of different bodily build and of different culture and the vexed problem of what is due to nature and what to culture comes up in acute form.

First of all the naive assumption that any kind of difference in bodily form must necessarily be correlated with some kind of behavior can not be accepted as proved. We may grant that the fundamental constitution of the body of the individual is dependent upon the activity of the system of his glands or upon any other factors that affect the physiological functioning of the body and that this is a determinant of behavior, but we have no indication that such traits, like color of hair and eyes, form of hair, form of head or nose, are in any way closely related with mental traits. Even observations on general constitution do not indicate a close correlation between form and function. To a certain extent racial types may be compared with constitutional types. Negroes are more leptosome than East Asiatics. It is quite a different question whether this would mean that the Negro behaves more like the leptosomes among Europeans, the East Asiatic more like the pyknics. Considering the weakness of this correlation among the Europeans and the fact that the leptosomy of the Negro is due to the greater length of the limbs it seems more than doubtful whether any correlation exists.

Some of the difficulties of transferring the results of observations in our culture appear in one of the most widely exploited psychological tests, the intelligence test. Since it is primarily intended to serve practical purposes its method violates a general principle of scientific procedure. It combines a great many distinctive activities into one single picture, while in scientific procedure we try to isolate so far as possible each element and correlate the results only after each has been treated separately. While this objection holds good merely for the scientific exploitation of the collected test material it is much more important for our problem to remember that the material on which the ultimate conclusions are based are individual reactions to phases of our culture and that, therefore, the experience of the individual in regard to these phases plays an essential part in his responses. I believe nowadays this is fully recognized by psychologists. It follows that the more diverse the cultures the less can a test based on the *form* of our culture give us any valid clue to estimate the intelligence of members of an alien society.

I fear that up to this time no methods have been found to describe or evaluate innate intelligence and still less innate personality. We have to learn to place individuals in strictly analogous situations and observe their reactions; but how can that be done? We know that the general social experiences and habits of individuals in the same culture vary considerably and that they vary still more in different cultures. We learn from the results of psychoanalytic studies, no matter how doubtful most of their results may be, that early experiences have a deep effect upon later behavior. At present I should be more inclined to rely on observations on behavior in which traditional habits play a comparatively slight role or may be readily recognized. Intelligent behavior in the solution of difficult problems that arise in everyday life and choice in situations that admit of various solutions combined with a knowledge of customary habits of the people permit us to compare with a fair degree of certainty the behavior of alien people and our own. My judgment based on long and varied contact with so-called primitives gives me the impression that intelligence and personality, vague as these terms may be, are distributed in about the same way as among ourselves. I wish I could see a clearer way to give a definite answer to this problem, but as long as we are unable to analyze more clearly what is meant by intelligence and personality I fear that we shall not be able to give a more definite answer to these questions. By analogy based on the distribution of physiological reactions of the body, we may infer that there are not material differences between members of our own and alien societies.

Since the assimilation of the individual to culture is a gradual process some light on the development of behavior may be obtained through the study of infants and older children and through behavior during adolescence. The results so far obtained are promising particularly in showing how the experiences of early childhood determine behavior, partly by unconscious imitation, partly by the kind of behavior expected from the children and impressed upon them by educational methods.

The desire for quantitative exactness has led to the attempt to utilize statistics of observations on behavior for the purpose of characterizing cultures as a whole and of determining the extent of individual variation. I confess that I have serious doubts in regard to the value of such statistics. In early years I have indulged in such statistics of the geographical distribution of tales and their variants. I still believe that the method may be of value in such cases when we are sure of what we are comparing. Unfortunately there are too many cases in which the comparability of material is so uncertain that a statistical comparison is not admissible. The fundamental demand for the applicability of statistical treatment must be that we are comparing classes of phenomena that belong together. When I wish to compare the health condition of two cities and base my conclusions on mortality rates without knowing the age distribution of the population I obtain a meaningless result. There are so many unknown elements involved in questionnaires and in the listing of specific forms of behavior that we are seldom sure what the answer means. I believe every one will agree that the answers to a Gallup poll depend both upon the selection of the public and the formulation of the question. An Indian whose economic security is endangered by his relation to Whites will be more apt to talk to a White man about these troubles than to his neighbor who wants to marry his daughter. The greater certainty of conclusions reached by such statistics is fictitious.

There is one more subject about which I ought to speak, that I take up with some hesitation. It is the psychiatric approach to anthropological data. I hesitate because I am unfamiliar with the curative value of processes the theoretical value of which seems to me very dubious. I can see that the expression of organic mental disturbances in different cultures will lead to different manifestations and that in this sense the study of abnormal mental behavior may be helpful to the student of mental diseases, but I think it is very unlikely that it will help us much in understanding the normal phenomena of culture. I believe particularly that the use of psychoanalysis for attacking the problems of primitive culture can not bear the light of a careful critical examination. I accept as an important contribution the effect of experiences in early life upon the personality of the individual, but when the attempt is made to explain mythology, totemism, taboo on the basis of psychoanalytic theories I can not follow. There are so many hypotheses involved in each step that it seems to me that the results can no longer be called scientifically sound.

Reviewing the development of anthropology as a whole I think we may rejoice in the many new lines of research that have been taken up. That many of the new methods need improvement is obvious but unavoidable in new, untested lines of approach. There is perhaps some danger that, engrossed in the difficult psychological problems involved in the analysis of culture, we may forget the importance of the general historical problem with which our science started, but I am certain that with the broadening of our view the varied approaches to an understanding of the history of mankind will be harmoniously elaborated and lead us to a better understanding of our own society.

OBITUARY

DEATHS AND MEMORIALS

Dr. Louis B. Wilson, for twenty-two years director of the Mayo Foundation, Rochester, Minn., until his retirement in 1937, died on October 5. He was seventy-six years old.

Dr. Elmer Darwin Ball, Assistant Secretary of Agriculture under Presidents Woodrow Wilson and Warren G. Harding, died on October 5. He was seventy-three years old. Dr. Ball had been dean of the College of Agriculture of the University of Arizona and director of the agricultural experiment station. At the time of his death he was on leave as professor of zoology and entomology.

Dr. Leo Buerger, of New York City, surgeon and urologist, died on October 6 at the age of sixty-four years.

Dr. Arthur T. Evans, head of the department of botany at Miami University, died on October 6 at the age of fifty-five years.

Dr. Samuel Ruben, of the University of California at Berkeley, died on September 28 as the result of an explosion in the chemical laboratory. He was thirty years old. His work was in the field of photosynthesis and he was engaged on investigations with the Office of Scientific Research and Development.

Dr. George Arnold Burbidge, dean of the Maritime College of Pharmacy, member of the faculty of Dalhousie University and a former chairman of the council of the Canadian Pharmaceutical Association, died on September 29. He was seventy-two years old.

A BRONZE plaque will be unveiled on Founders Day of Lehigh University on October 18 on the site of the first college Hydraulic Laboratory, which was built by Dr. Mansfield Merriman, formerly professor of civil engineering in the university.

THE California Academy of Sciences held a meeting on October 6 at the Medical Center in San Francisco of the University of California in recognition of the quadricentennial of Vesalius's great work, "De Humani Corporis Fabrica," which was published in 1543. The principal address was given by Dr. J. B. deC. M. Saunders, chairman of the department of anatomy, who spoke on "Andreas Vesalius, the Anatomist."

SCIENTIFIC EVENTS

PREFERENCE ORDER FOR REAGENT CHEMICALS

THE following preference rating order P-135 was issued on September 28 by the War Production Board.

(a) *Definitions for the purposes of this order:*

(1) "Reagent chemical" means any chemical prepared and packed for reagent use in laboratories.

(2) "Laboratory" means any person engaged in the business of carrying on scientific or technological investigation, testing, development or experimentation, to the extent that he is so engaged. The term includes research laboratories, production control laboratories, clinical laboratories and instructional laboratories. It does not include any person to the extent that he is engaged in the manufacture of products for commercial sale, even though the place in which the products are manufactured may be called a laboratory.

(3) "Distributor" means any person who buys reagent chemicals for resale without further processing.

(4) "Producer" means any person engaged in the production of reagent chemicals and includes any person who has them produced for him pursuant to toll agreement.

(b) *Assignment of preference ratings.*

(1) Preference rating AA-1 is hereby assigned to deliveries of any reagent chemical to any laboratory to which a serial number has been assigned under Preference Rating Order P-43, and to any laboratory owned and operated by the Army or Navy of the United States.

(2) Preference rating AA-2 is hereby assigned to:

(i) Deliveries of any reagent chemical to any laboratory to which a serial number has not been assigned under Preference Rating Order P-43.

(ii) Deliveries of any reagent chemical to a distributor or producer.

(c) *Application and extension of rating.* The preference rating assigned by paragraph (b) hereof shall, subject to the provisions of paragraph (d) hereof, be applied or extended only in accordance with the provisions of Priorities Regulation No. 3, as amended from time to time.

(d) *Restrictions on applications and extensions of rating.* The preference rating hereby assigned shall not be applied:

(1) To obtain deliveries of any reagent chemical or material:

(i) Which will be incorporated in, or which will enter into, any chemical reaction directly involved in the manufacture of any product, other than a reagent chemical, manufactured for sale;

(ii) Which will be used in the rendering of any service other than analytical, testing, control, educational or research laboratory services.

(2) To obtain deliveries during any calendar quarter of reagent chemicals, and material (not including maintenance, repair and operating supplies) which will enter, at any stage, into the production of reagent chemicals, greater in dollar value than the sum of the following:

(i) Twenty-five per cent. (25 per cent.) of the total dollar value of reagent chemicals and such material delivered, for analytical, testing, control or research purposes (exclusive of educational purposes) or for the manufacture of such reagent chemicals, to the person applying the rating hereby assigned during the twelve (12) month period ended September 30, 1942, and

(ii) One hundred per cent. (100 per cent.) of the total dollar value of reagent chemicals and such material delivered, for educational purposes or for the manufacture of reagent chemicals for such purposes, to the person applying the rating hereby assigned during such twelve (12) month period: *Provided, however,* That the dollar value of deliveries of reagent chemicals for educational purposes and of material which will enter into the production of reagent chemicals for educational purposes, to which such preference rating may be applied in any four successive quarters shall not exceed one hundred per cent. (100 per cent.) of the total dollar value of reagent chemicals and such material delivered for such purposes to the person applying the rating during such twelve (12) month period.

(3) If during any calendar quarter or other applicable period the dollar volume of production, services rendered, appropriations for research or number of students enrolled, by the person applying the rating hereby assigned, is greater than for the corresponding quarter or other period of the twelve (12) months ended September 30, 1942, the allowable dollar value to which the rating hereby assigned may be applied in terms of paragraph (d) (2), may be increased in proportion to the increase in production, services rendered, research appropriation or enrollment.

(4) The quantitative restrictions of CMP Regulations 5 and 5A shall not apply to deliveries of reagent chemi-

cals or of material (not including maintenance, repair and operating supplies) which will enter into the production of reagent chemicals.

(e) *Miscellaneous provisions:* (1) *Applicability of priorities regulations.* This order and all transactions affected hereby are subject to all applicable provisions of priorities regulations of the War Production Board, as amended from time to time.

(2) *Communications to War Production Board.* All communications concerning this order shall, unless otherwise directed, be addressed to: War Production Board, Chemicals Division, Washington, D. C., Ref.: P-135.

THE GUGGENHEIM LATIN AMERICAN FELLOWSHIPS

FIFTEEN fellowships have been awarded to Latin American scholars and artists in the fourteenth annual Latin American fellowship competition of the John Simon Guggenheim Memorial Foundation. The Latin American fellowships were established in the year 1929 by the late U. S. Senator Simon Guggenheim and by Mrs. Guggenheim as part of the activities of the foundation which they set up in 1925, in memory of a son. The Latin American fellows carry on their work in the United States.

The fellowships are granted annually to assist research and creative work in all fields of art and scholarship. The stipend is usually $2,000 for a year, plus sums for traveling expenses to the United States and return. The fifteen fellowships awarded this year are distributed as follows: three to Mexico, four to Argentina, two each to Brazil, Chile and Cuba, and one each to Peru and Puerto Rico. Two fellowships were granted to artists, two to economists, two to historians, one to a mathematician, one to a poet and seven to biologists. Fellowships in the sciences are:

José Antonio Goyco, assistant in chemistry, School of Tropical Medicine, University of Puerto Rico. *Project:* Studies in the field of food technology with special reference to high-yielding tropical crops. Mr. Goyco's work will be concerned with the production, processing and preservation of foods in the tropics as part of a hoped-for solution of the problem of a large undernourished population in the tropical belt of the world.

Mario Autuori, assistant in the Biological Institute, São Paulo, Brazil. *Project:* Studies of the biology of the fungus-growing ants. These ants are the chief enemies of Brazilian agriculture. Mr. Autuori's studies are designed to give fundamental bases for their control.

Dr. Isabel P. Farfante, instructor in zoology, Faculty of Science, University of Havana, Cuba. *Project:* Studies of methods of increasing the supply of edible mollusks and crustaceans in Cuban waters. This is Dr. Farfante's second Guggenheim Fellowship and she is the only woman appointed this year to a Latin American Fellowship.

Juan Ignacio Valencia, agrostologist, Darwin Botanical Institute, Buenos Aires, Argentina. *Project:* Continuation of studies of South American forage plants, especially corn, under the direction of Dr. Paul Weatherwax at the University of Indiana.

Raúl Cortés Peña, entomologist, Ministry of Agriculture, Santiago de Chile, and professor in the faculty of agronomy, Catholic University of Chile. *Project:* Continuation of studies of the methods used in the United States for the biological control of insect pests.

Dr. Gabriel Gasić Livacić, chief of the laboratory, Institute of Biology of the University of Chile. *Project:* Studies in the fields of hematology and endocrinology.

Dr. Fabio Leoni Werneck, chief of the laboratory, Instituto Oswaldo Cruz, Rio de Janeiro. *Project:* The preparation of a monograph on the Mallophaga of mammals. Dr. Werneck's work will be carried on in the U. S. National Museum and at Stanford University, California.

Jaime Lifshitz Gaj, research assistant in the Institute of Physics and professor in the faculty of sciences of the National University of Mexico. *Project:* Mathematical studies of the general theory of orbits, under the direction of Professor George D. Birkhoff at Harvard University.

The committee of selection consisted of Dr. Frank Aydelotte, director of the Institute for Advanced Study, Princeton, *Chairman;* Dr. Thomas Barbour, director of the Museum of Comparative Zoology, Harvard University; Dr. Percival Bailey, professor of neurology and neurosurgery, Medical School, University of Illinois; Dr. Américo Castro, professor of Spanish, Princeton University; and Dr. Elmer Drew Merrill, professor of botany and director of botanical collections, Harvard University. In making their selections, this committee was assisted by many eminent Latin American scholars and authorities in the fields of the applicants' work.

The foundation gives opportunities to men and women of the highest ability to further their work—assistance being available to scholars working in any field of knowledge and to artists working in any branch of the arts. They are open without distinction on account of race, color or creed to men and women, married or unmarried. They are granted only to persons who, by work accomplished, have already proved themselves to be of the highest ability. Normally the ages of the fellows are between twenty-five and forty years.

GRANT TO THE NATIONAL RESEARCH COUNCIL FROM THE JOHNSON AND JOHNSON RESEARCH FOUNDATION

DR. ROSS G. HARRISON, chairman of the National Research Council, announces the acceptance by the National Academy of Sciences—National Research Council of a grant from the Johnson and Johnson Research Foundation in the amount of $75,000. The grant was made to enable the Division of Medical Sciences of the council, under the chairmanship of Dr. Lewis H. Weed, to gather current medical information pertaining to the war effort and to disseminate summaries. The program of the Division of Medical Sciences of the National Research Council contemplates coverage of the various medical reports and bulletins which emanate from civilian and military activities throughout the world. The enterprise should fill a much-needed gap in the war effort in medicine; for one of the greatest difficulties encountered in medicine to-day lies in providing adequate up-to-date information to the medical officers of the armed services both in this country and abroad and in making the experience of war medicine available as far as possible to civilian physicians.

The Johnson and Johnson Research Foundation appropriation to the National Research Council becomes immediately available; in accordance with present plans it will be utilized in the period up to June 30, 1945. A central office will be established in Washington and reporters will be appointed in various foreign countries, so that a staff of special observers abroad will be working under the direction of the central office. The various theaters of operation present medical problems in which climate, season of year, distribution of insects and distribution of disease all play different roles. Reports from widely separated parts of the world will be of the greatest medical importance and it is hoped that out of the combined efforts much of significance will be achieved.

Many of the observations and laboratory studies can not be released at present because of the classified information contained in them—information of military importance. Such materials will be carefully held until release may be made. Every effort will be made, however, to issue bulletins containing current advances in medical practice and medical research which are not military secrets and which should be made available to the medical profession at the earliest possible date. This collection will form basic source material for later summaries of medical experience in the present world war. Not only data from the armed forces will be included, but also material from other federal agencies and from civilian enterprises.

The informational service will be under the direction of the committee on information of the Division of Medical Sciences, which includes Dr. Morris Fishbein, *Chairman,* Dr. John F. Fulton, Dr. Richard M. Hewitt and Dr. Robert N. Nye, with liaison officers appointed by the three Surgeons General.

The Johnson and Johnson Research Foundation was established on January 1, 1940, as a non-profit philanthropic organization by Johnson and Johnson, New Brunswick, N. J., with the express purpose of supporting research and development of products to serve the medical profession. It has made appropriations for both fundamental and developmental investigations and is currently sponsoring about a hundred projects in twenty-eight universities. The fields of medical interest which have largely been supported are pharmacology (including antiseptics), allergy, physiological studies in pediatrics and human fertility.

SCIENTIFIC NOTES AND NEWS

THE Earl of Athlone, chancellor of the University of London, conferred the honorary degree of doctor of laws on President Roosevelt on August 25 on the occasion of his recent visit to Ottawa. The oration was read by Captain C. H. Best, professor of physiology at the University of Toronto.

AT a recent meeting of the Cancer Advisory Committee a portrait of himself was presented to Dr. Carl Voegtlin, who resigned recently as director of the National Cancer Institute of the U. S. Public Health Service.

A BUST of Albert Einstein, one of four replicas, has been presented by George Haight to the regents of the University of Wisconsin.

RAPHAEL L. STERN, chemical superintendent of the Parlin plant of the Hercules Powder Company, known for his adaptation of wood pulp in the manufacture of smokeless powder, which has increased the output of explosives, was awarded on October 4 a citation by the Ordnance Department of the United States Army for "distinguished service to his country."

DR. HAROLD GRAY, technical supervisor of the tire division of the B. F. Goodrich Company, Akron, Ohio, has been elected chairman of the rubber division of the American Chemical Society. He succeeds Dr. John T. Blake, chief chemist of the Simplex Wire and Cable Company, Cambridge, Mass. Dr. W. A. Gibbons, of the United States Rubber Company, New York City, has been chosen vice-chairman.

HAROLD F. HAMOND, director of the traffic and transportation division of the National Conservation Bureau, has been elected president of the Institute of Traffic Engineers.

SIR STANLEY WOODWARK has been elected Master of the Society of Apothecaries of London for the third consecutive year; Dr. J. P. Hedley has been elected senior warden and Dr. Hugh F. Powell junior warden.

DR. DONALD HUNTER COOK, of the School of Tropical Medicine, San Juan, Puerto Rico, has been appointed visiting professor of chemistry at Columbia University.

DR. E. L. STOVER, head of the department of botany of the Eastern Illinois State Teachers College at Charleston, is spending the current academic year at the University of Illinois as visiting professor of botany. Professor Stover, who is chairman of the Committee on Instruction in the Biological Sciences of the National Research Council, will have charge of the beginning courses in botany.

After fifty years of academic service Dr. Henry E. Crampton has retired with the title of emeritus professor of zoology of Columbia University. The authorities of the American Museum of Natural History have provided him with facilities to continue his researches on the distribution, variation, evolution and heredity of gasteropod mollusca, especially in Partula and in Lymnaea. Dr. Crampton has made several expeditions to the South Seas for the collection of series of individuals of the species of Partula, having about 250,000 individuals of that genus. Three volumes of the results of his work have appeared, and the material for still others is undergoing preparation.

Dr. E. O. Essig, professor of entomology at the University of California at Berkeley and entomologist of the Agricultural Experiment Station, has been appointed head of the division of entomology and parasitology. He has served as acting head of the division since February 17.

Dr. Harold William Brown, who has returned from the Virgin Islands, where he spent some time working on filariasis, has been made professor of parasitology at Columbia University. This appointment marks the beginning of a new program in tropical medicine at the Columbia-Presbyterian Medical Center. Dr. Brown is the first member of a faculty for training and research in tropical diseases which will function under the immediate direction of the DeLamar Institute of Public Health, a division of the Medical School. This program has been made possible by a grant from the Josiah Macy Jr. Foundation. The personnel of the new department probably will not be completely assembled until after the war.

Wallace Worzella, of Purdue University, has become head of the department of agronomy at South Dakota State College at Brookings.

Dr. Stanley Wawzonek, of the department of chemistry at the University of Illinois, has been appointed instructor at the University of Tennessee to take the place of Dr. R. C. Millican, who has resigned to study medicine at the University of Tennessee Medical College at Memphis.

Dr. J. Harold Smith, instructor in chemistry at the University of Illinois, has been appointed associate professor of chemistry at Massachusetts State College.

The university correspondent of *The Times*, London, reports that during the war many of the professorial chairs in the universities have become vacant and the elections to them have been held in suspense by the council of the Senate. The whole situation was discussed by the Regent House last November; and in the Lent term of this year nineteen vacancies were considered by the faculty boards and other bodies. In several cases, where the reason for it has ceased, the suspension has been terminated by grace; and since the beginning of the Easter term the following elections have been made at the University of Cambridge: to the Sir William Dunn professorship of biochemistry, Dr. Albert Charles Chibnall, Clare College; to the professorship of mechanical sciences, Dr. John Fleetwood Baker, Clare College; to the Arthur Balfour professorship of genetics, Dr. Ronald Aylmer Fisher, Gonville and Caius College; to the Quick professorship of biology, David Keilin, fellow of Magdalene College (re-elected), and to the Woodwardian professorship of geology, Dr. William Bernard Robinson King, fellow of Magdalene College.

Lewis S. Munson, who, as production superintendent and later plant manager of the du Pont Dye Works, played an important part in building the American dye industry, has retired at the age of seventy years. He had been connected with the du Pont Company since 1918.

Dr. George M. Reed, curator of plant pathology at the Brooklyn Botanic Garden, has been appointed acting director of the garden. He will fill the vacancy caused by the death on August 9 of Dr. C. Stuart Gager.

Dr. Fred J. Seaver has been appointed head curator at the New York Botanical Garden to succeed Dr. H. A. Gleason, who has retired to devote himself more completely to research. Dr. Gleason will remain as curator and assistant director. Dr. Seaver is managing editor of *Mycologia* and has been on the staff of the garden since 1908.

Alden H. Emery, assistant manager, has been made acting secretary and acting business manager of the American Chemical Society during any absence of Dr. Charles L. Parsons, secretary and business manager of the society.

Dr. Melville H. Manson has been appointed medical director of the American Telephone and Telegraph Company to succeed Dr. Cassius H. Watson, who retired on October 1. Dr. Manson has been medical director of the New York Telephone Company since 1942 and was formerly medical director of the Bell Telephone Laboratories.

John A. Hutcheson, engineering manager of the Baltimore Radio Division of the Westinghouse Electric and Manufacturing Company, has been appointed associate director of the Westinghouse Research Laboratories. He will direct wartime micro-wave research, but his work will include all phases of research engineering.

Douglas G. Woolf, after serving for twenty-seven years, has resigned as editor-in-chief of the *Textile World,* to become vice-president and director of information of the Textile Research Institute, Inc.

Dr. V. A. Tiedjens, associate olericulturist at Rutgers University and the New Jersey Agricultural Experiment Station, returned on September 27 from the islands of Aruba and Curaçao, where he conducted a survey to determine the possibilities of growing perishable foods on the islands. He was sent at the request of the Standard Oil Company of New Jersey. While on the islands he was assisted by officials of the company as well as by R. J. Beaujon, director of the Department of Landbau, Veedeelt and Visschery, of the Netherlands West Indies Government. Due to the scarcity of soil and fresh water on the islands the possibility of using soilless culture methods to grow food plants was given serious consideration.

Dr. R. B. Stevens, now on leave from Birmingham-Southern College, has been commissioned Second Lieutenant in the Sanitary Corps of the Army.

Miss Eliza Hirschhorn, of the faculty of the National University of Argentina, is visiting the United States. She plans to work for an advanced degree in agriculture and to engage in research on smuts. Miss Hirschhorn holds a research fellowship at Washington State College.

Dr. Parker D. Trask, geologist with the U. S. Geological Survey, gave before the section of geology of the New York Academy of Sciences on October 4 an illustrated address entitled "The Mexican Volcano Paricutin, and its Geologic Setting." He gave a first-hand description of the remarkable new volcano, which suddenly appeared on February 20 and has already grown to a height of nearly 1,000 feet.

The British Broadcasting Corporation has arranged a series of twelve weekly talks on applied physical science, which began on October 1, under the title "Science at Your Service." An attempt is to be made to bring before the layman the numerous ways in which physical science is being used in everyday life and to show that an understanding of the principles of science is essential in the post-war world. The addresses will deal with the home, building construction, plastics, clothing and fabrics, explosives, the structure of the earth's crust, the weather, planning fisheries, life-saving at sea, shipbuilding and tunnelling. It is expected that the speakers will include Sir Lawrence Bragg, Sir Edward Appleton, Sir George Burt and Sir Charles Darwin.

The annual joint meeting of the Institute of Medicine of Chicago and the Chicago Society of Internal Medicine will be held at the Palmer House on Monday evening, October 25, when Dr. Conrad A. Elvehjem, professor of biochemistry at the University of Wisconsin, will lecture on "The Nutritional Significance of the Newer Members of the Vitamin B Complex."

A Joint Fuels Conference of the American Institute of Mining Engineers and the American Society of Mechanical Engineers will be held at the Hotel William Penn, Pittsburgh, on October 28 and 29.

The annual meeting of the American Dental Association was held at the Netherland Plaza Hotel, Cincinnati, from October 11 to 13. Because of wartime conditions, the meeting was limited to the transaction of essential business by the house of delegates, with no program of scientific papers or clinics.

The twenty-third annual meeting of the Highway Research Board will be held this year from November 27 to 30 at the Edgewater Beach Hotel, Chicago. The first two days will be devoted to meetings of the various committees and departments. Sessions of the board for the presentation and discussion of papers relating to highway finance, economics, design, materials, construction, maintenance, traffic and soils investigations will be held on November 29 and 30.

The South Eastern Pennsylvania Section of the American Chemical Society will meet at Lancaster, Pa., on October 21.

At the celebration of the golden jubilee of the medical school of Tufts College, President Leonard Carmichael announced that a gift of $125,000 had been made to the building fund.

A bequest has been made to the University of Michigan, in the will of the late John H. Darling, of Duluth, Minnesota, amounting to over $25,000. It will be added to the Mortimer E. Cooley Foundation of Engineering.

The University of Texas Chapter of the Phi Beta Pi Medical Fraternity has given funds to the Medical Branch of the University of Texas at Galveston for the purpose of establishing an annual lectureship.

Those engaged in production of iron and steel who are eligible to use the maintenance, repair and operating supplies preference ratings assigned by Preference Rating Order P-68, the W.P.B. rules, may use the AA-1 rating assigned by it to obtain laboratory instruments and equipment. This is an amendment to Priorities Regulation 3, issued September 27.

DISCUSSION

AMERICAN STANDARD LETTER SYMBOLS FOR HEAT AND THERMODYNAMICS

There recently has been issued by the American Standards Association, 29 West 39th Street, New York City, "Letter Symbols for Heat and Thermodynamics Including Heat Flow," Z10.4–1943, price 55 cents. This is in continuation of a project initiated some years ago—"Standardization of Scientific and Engineering Symbols and Abbreviations"—under the sponsorship of the American Association for the Advancement of Science, the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers and the Society for the Promotion of Engineering Education; to be carried out under the procedure of the American Standards Association.

As a result, there were issued lists of American Standard Symbols in a number of fields. Some recently have been revised and re-issued: "Letter Symbols for Hydraulics," ASA Z10.2–1942, price 35 cents; "Letter Symbols for Mechanics of Solid Bodies," ASA Z10.3–1942, price 25 cents; "Illuminating Engineering Nomenclature and Photometric Standards," ASA Z7.1–1942, price 25 cents; and now the Thermodynamic Symbols above mentioned. Other revised lists of previously issued standards and some new lists are in progress.

A letter symbol is defined as "a single character, with subscript or superscript if required, used to denote a physical magnitude in mathematical equations and expressions." A person who uses thermodynamics, or any other engineer or worker in applied sciences, has an infinite number of problems, each in the content of his own rapidly expanding specialty. So he can concentrate his brains on his specialty, if mathematics and symbols are standardized so as to be labor-saving tools. Then he doesn't need to spend mental effort on the language or form of a formula, but only on its underlying principles.

The most important way in which this standardization helps scientists and engineers is the arrangement that all authors writing on a given subject shall use the same meanings for the letter symbols in their formulas. For example, D in a formula always denotes "Diameter." Readers readily learn such a set of standard symbols when the same ones are used in all publications, and are thereafter saved an appreciable amount of mental effort.

At the present time a university student who may be taking courses in engineering thermodynamics, physical chemistry, theoretical chemistry and chemical engineering usually finds an entirely different set of symbols used for given concepts in each of the fields mentioned. The mental readjustment that is required each time a student starts a new recitation gives a handicap which symbols standardization eliminates.

A completely logical list of symbols would have a single symbol for every concept, no matter in what field it might be used, and would have all symbols selected on a sound theoretical basis, regardless of present usages. But in default of an International Dictator to enforce such an allegedly logical list, it just wouldn't be accepted. Lots of symbols lists have been set forth by committees who proposed to reform symbols usages, which have accomplished nothing beyond collection of dust on volumes of "Proceedings" in technical libraries. But we expect that the American Standard lists of letter symbols are going to merit actual use, and so we have tried to make a realistic compromise between existing usages, and idealism.

International Symbols Standardization

In many cases letter symbols are the initial letters of names. The fact that different languages use different names has started the use of completely different letter symbols for the same concept in nations using different languages. For this reason, international standardization of symbols for all fields of science and technology seems impossible at the minute. However, in the case of people using the English language, the possibilities are much brighter.

At the present time, even though people in the United States, Canada, England and other parts of the British Empire speak nearly the same language, there is great diversity in the letter symbols used in textbooks and other scientific publications. This is in spite of the fact that books published in each nation are used freely in the other, that colleges exchange students, and that commercial concerns in each country have affiliates overseas. Hence, standardization by both nations in cooperation would be very advantageous.

With this in mind the Royal Society of England arranged that the British Standards Institution start collaboration on lists of letter symbols for the English language, with other Empire standards associations, the Canadian Engineering Standards Association and the American Standards Association. The two latter bodies accepted the proposition.

The writer was in England in 1938 as delegate to a meeting at Torquay of the International Electrotechnical Commission, where symbols for electrical quantities were pretty well settled internationally. While in England the writer participated in the above-mentioned arrangements for symbols for the English language for other fields, and definite progress was made in this direction. However, the impact of war on England presently compelled postponement of the project there. The American and Canadian Standards Associations have continued, with such information about the English point of view that it is hoped that the ASA lists being issued will require but little addition when letter symbols for the English language again come to be considered. Furthermore, the American lists will give standards for our use until this happy time comes, and will furnish a definite statement of the American point of view when it does come.

Further information about the details of the American Standards Association symbols project, with reasons for the selections in particular cases of the symbols for heat and thermodynamics, are given in articles appearing in the September issues of *Mechanical Engineering*, published by the American Society of Mechanical Engineers, the *American Journal of Physics* and *Industrial Standardization.*

Sanford A. Moss

General Electric Company,
West Lynn, Mass.

A TEXAS SKELETON

High water on June 24 caved off the nearly vertical bank of the Brazos River sixty miles northeast of Abilene, Texas, and exposed a flexed human skeleton at a depth below the present soil surface of twenty-one feet. The top of the bank at the site is thirty-two feet above low-water level; and the bands of silt formation above the grave are regular and unbroken for considerable distances on each side and above the burial. Where the burial was made the silt banding rises to a somewhat higher level than the same bands do a short distance above and below it. Evidently burial was made in a shallow grave on a slightly higher point along the river bank and subsequently twenty-one feet of river silt has covered the whole valley floor. There were no stones, shells or artifacts in the grave. The head was buried a little higher than the body, which lay flexed on the left side, and surrounded by ashes and charcoal. The bones are hard and evidently somewhat mineralized.

The skull was exposed by high water and most of the hand bones—the hands were usually placed on each side of the face in Abilene region flexed burials—were washed away. Part of the skull top and the left side of the skull were also washed away. The frontal bone, the lower jaw and teeth, and the right side of the skull and other parts were found still embedded in the bank eleven feet above low-water level by a boy swimming below it. The boy, James Putnam, and a companion dug out the remaining skull bones with pocket knives; and his uncle, J. C. Putnam, took them sixty miles to Abilene on the 26th. Mr. Putnam has watched the river banks for bones ever since 1929, when the writer excavated two peculiar skeletons buried six and a half feet deep in a Brazos River bank.[1, 2]

In 1939 Mr. Putnam had also brought information of the washing out of another skeleton in a river bank near by at below nine feet from the soil surface.[3]

On June 27 the writer and a local geologist, H. H. Adams, went to the site, photographed the plainly seen skull mold, and with the assistance of J. C. Putnam and James P. Putnam, the ranch owners, excavated the remainder of the skeleton, which lay farther back in the bank. The condition of the caving bank did not justify delay and another rise might have removed the bones.

Most of the long bones were found, and these have some peculiar curvatures and torsions, which call for careful study. On the skull the brow ridges are thick, and the upper portion of the frontal bone near the articular surface is more than three eighths of an inch thick.

There is a thick stratum of ashes eight feet beneath the burial which bands the bank for a considerable distance, but whether this is due to human or natural agencies is not yet known. This burial is far deeper than any previously found in the Abilene region.

Dr. Frank H. H. Roberts, Jr., of the Bureau of American Ethnology, was asked to inspect the site, and he came on July 7 and remained five days studying the burial site and also many other deeply buried midden strata in various stream banks of the Abilene region. The skeleton will be sent to Dr. Roberts at the Smithsonian Institution for scientific study.

Cyrus N. Ray

Abilene, Texas

TRANSLITERATION OF ENGLISH NAMES INTO RUSSIAN

In the September 3d issue of Science, there is a note by the late Aleš Hrdlička on the transliteration of English names into Russian. The author states, quite rightly, that there is no "w" in Russian, and that this sound in his opinion should be represented by "v," while Russians in general represent it by "u," the examples mentioned being "Wendell Willkie" and "New York." Possibly there are some who do transliterate Willkie as Uillkie, but it is far from general. For instance, in the Russian newspaper, "Novoye Russkoye Slovo," published in New York, this name is transliterated as "Vilki." "W" in this first example sounds more like "v" than "u." In the second example, in "New York" "w" sounds more like "u," and so it is usually transliterated as "Niu." The use of "v" in this word would make it sound like

---

[1] Cyrus N. Ray, *Scientific American*, May, 1929.

[2] J. Alden Mason, *The Museum Journal*, September–December, 1929, The Museum of The University of Pennsylvania.

[3] Cyrus N. Ray, Plate 52, *Bulletin* of Texas Archeological and Paleontological Society, Vol. 11, 1939.

"Nev," which would not correspond to the pronunciation of the word at all.

As for the "h" sound, if one would only take the trouble to look to page 344 in Alexandrow's dictionary, which is probably the most complete Russian-English and English-Russian dictionary, one would see that the word "hall" mentioned by Aleš Hrdlička is transliterated as "hol" and not "gol," along with a score of other words containing the same letter "h."

As for the English "sh," no Russian would ever use "š" as suggested by Hrdlička, since there is no letter "š" in Russian. This letter appears in the Czech language and possibly a Czech might use it, but certainly not a Russian. To do such a thing for a Russian would be similar to a case of an American wanting to use some Chinese or Hebrew letters in transliterating Russian names into English. In transliterating names like "Shaw," the sound "aw" is sometimes transliterated as "ou."

No matter how carefully one tries to transliterate English names into Russian, it can not be done exactly, as there are many English sounds that have no corresponding ones in Russian and *vice versa*. Some Russian scientific publications follow the practise of retaining English names in their original form, printing them in Latin letters. This is an exact method, which leaves no room for any distortions or ambiguities. I believe that, if this practice is more generally used, it might prove to be the best and simplest way of solving this problem.

Valentina Krotkov
Queen's University, Kingston, Ont., Can.

SCIENTIFIC BOOKS

TROPICAL DISEASES

Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases. By Richard P. Strong. 1747 pp. Philadelphia: The Blakiston Company. $21.00.

Stitt's "Diagnostics and Treatment of Tropical Diseases" went through five editions under the able authorship of Rear Admiral E. R. Stitt, Medical Corps, U. S. Navy. The first edition appeared in 1914 and the fifth in 1929. The sixth edition of this well-known American text-book of tropical medicine was published in 1942, and reprinted after further revision in 1943 under the authorship of Dr. Richard P. Strong.

The increase in knowledge of tropical and parasitic diseases accumulated in the twelve years intervening between the appearance of the fifth and sixth editions, together with the obvious needs for providing more detailed information concerning the epidemiology and methods of control of communicable diseases, necessitated enlargement to two volumes.

As is pointed out by Rear Admiral E. R. Stitt in the foreword, Dr. Richard P. Strong brought to the task of revision an unusually broad experience in tropical medicine in many parts of the world. His post as president of the Army Tropical Disease Board in the Philippines; professor of tropical medicine at the University of the Philippines, and subsequently at Harvard; his activities as chairman of Red Cross Commissions for the investigation of pneumonic plague in Manchuria, typhus fever in the Balkans and trench fever in France during the first World War, and his expeditions to Africa, the Amazon and other areas of Central and South America have equipped him with intimate personal knowledge of the field problems in many aspects of tropical medicine. His own investigations in the dysenteries, plague, trypanosomiasis, bartonellosis and onchocerciasis have constituted important contributions to our knowledge of these diseases and likewise have provided a critique for his treatment of the whole field of tropical medicine. This unusually rich personal experience is amply reflected throughout the book.

The text is arranged in a series of Sections. Section I deals with "Diseases Due to Protozoa"; Section II—"Diseases Due to Bacteria"; Section III—"Diseases Due to Filterable Viruses, Rickettsiae and Allied Organisms"; Section IV—"The Nutritional Disorders"; Section V—"Diseases Not Included in Other Categories," including effects of heat, tropical ulcer, granuloma venereum, climatic bubo and other rarer conditions; Section VI—"Diseases Due to Fungi and Poisonous Plants"; Section VII—"Diseases Due to Animal Parasites," including the role of arthropods in the transmission of disease, poisonous snakes and lizards, fish and coelenterates; Section VIII deals with general considerations of medical practice in tropical areas.

Following the text is an appendix which presents an index to clinical diagnosis, alphabetically arranged, an index of laboratory diagnostic procedures and a section on personal hygiene, tropical hygiene and sanitation.

The sections devoted to descriptions of the particular diseases constitute excellent presentations of the most authoritative data in sufficient detail to make this an excellent reference work, as well as an essential volume for the practitioner of clinical medicine in the tropics.

The selected bibliography which follows each section provides a list of the more important fundamental articles dealing with the subject which adds greatly to the value of the book as a whole. Although it is difficult to single out particular sections, the presentation of malaria, dysenteries, the rickettsiae, plague, cholera, trypanosomiasis and the filarial diseases are noteworthy. The section on tropical hygiene and sanitation and the consideration of the general medical problems presented by practice in the tropics contain much useful information for individuals lacking special training. The index of clinical diagnosis and laboratory diagnosis are likewise useful for quick reference.

The two volumes are well printed and profusely illustrated with excellent and well-selected photographs and drawings. There are surprisingly few typographical errors.

This second printing of the sixth edition constitutes an outstanding contribution to the literature on tropical medicine. It provides an enormous amount of detailed information on many subjects and is an essential and practical text, both for the student and the practitioner in this field. There is no other single work which approaches the usefulness of this text.

Thomas T. Mackie

STATISTICAL TABLES

Statistical Tables for Biological, Agricultural and Medical Research. By Ronald A. Fisher and Frank Yates. Second edition. viii + 96 pp. London: Oliver and Boyd, Ltd. 1943.

In the past five years no book in my possession has had more constant use than the first edition of these tables. It has furnished in compact form the data needed in designing an experiment, computing its results and interpreting the statistics obtained by analysis. The second edition, therefore, is as welcome as an old friend.

Four new tables have been added, each with an explanatory introduction. Table V_1 by P. V. Sukhatme is based upon a compound of two student distributions and gives the Behrens-Fisher test at the five and one per cent. levels for the significance of the difference between two means. It applies where the variances estimated from two series differ significantly, so that they can not properly be pooled for the usual t-test of their means. Table V_2 expands the test at one limit of Table V_1, for comparisons where one variance is determined from a large number of observations and conforms to the normal distribution and the other, differing from it significantly, has been computed from a small series of Student's type. It may be noted, however, that the adequacy of the Behrens-Fisher test has been questioned by some mathematical statisticians who accept the rest of the book.

Table $VIII_1$ by W. L. Stevens gives the lower and upper limits of the expectation for the binomial and Poisson distributions at probabilities of .005, .025 and .1. If an event is observed to occur from 0 to 15 times (= a) in N trials, where N varies from 2a to ∞, the table gives directly for each probability the expected number of occurrences with which the observation is compatible. With Table $VIII_2$, also by Stevens, the experimenter can estimate the density of organisms in a culture and the variance of the estimate from the incidence of sterile and fertile tubes in two-fold, four-fold and ten-fold dilution series.

Modern experimental technique has been greatly strengthened by designs known as balanced incomplete blocks. Experimenters are well aware of the increase in precision when treatments can be compared on the same animal or plant or on litter mates or on smaller, more homogeneous areas of land. The designs shown in an expanded Table XVII enable the experimenter to compare many treatments with the precision formerly possible only when treatments were few or when one treatment in each small unit was allotted to a "control" or standard with the corresponding loss in efficiency. Answers are given for four of the "cases not yet solved" in Tables XVIII and XIX of the first edition and the introduction for this group of tables has been rewritten to include the Youden square and to describe the newer methods of analysis for recovering the information between as well as within blocks.

The new edition omits the description of how the tables of random numbers were prepared and checked, and other smaller changes are scattered through a very informative introduction. The references have been extended to a list of thirty. Errata for the first edition, all of which have been corrected in the second edition, follow the table of contents.

Other tables in the book are unchanged. These include with suitable introductions the normal distribution; the distribution of t and χ^2; z and the variance ratio (Snedecor's F) at four levels of significance; the correlation coefficient at different levels of significance and degrees of freedom; the transformation of r to z; tests of significance for 2×2 contingency tables; the probit and angular transformations and the terms needed in obtaining maximum likelihood solutions with them; an adequate series of Latin squares and complete sets of orthogonal squares; normalizing scores for ranked data to facilitate their use in the analysis of variance; initial differences of powers of natural numbers; orthogonal polynomials for fitting equations of the first to the fifth degree; common and natural 5-place logarithms; squares, square roots, reciprocals, factorials and selected trigonometric functions; six pages of random numbers and a concluding table of miscellaneous constants.

Additions that would be welcome in a third edition may be suggested. Since few biologists take readily to interpolation, several tables could be expanded to advantage. Thus the variance ratio might be given for more intermediate degrees of freedom, the angular transformation assigned a more detailed table and Tables VIII and XI expanded. Useful new tables could include tests for the significance of runs; the range of the normal distribution in different-sized samples at various levels of significance, in terms of the standard deviation computed with varying degrees of freedom; other terms of value in statistical control of quality; and criteria for identifying discordant observations. These omissions, however, are not vital. The appearance of a second edition on good paper, in the same convenient format as before and with as many additions as have been made, must rank as a real achievement under present war conditions.

C. I. Bliss

Connecticut Agricultural Experiment
Station

SPECIAL ARTICLES

A PROTECTIVE ANTISERUM AGAINST MOUSE PNEUMONITIS VIRUS[1]

A viral agent causing pneumonitis in mice has been isolated in this laboratory on two occasions, in 1938[2] and in 1940, by intranasal "blind passage" of the normal appearing lungs of white mice. A general study[3] of its properties indicates that it is similar if not identical to certain other latent pneumotropic viruses found in mice.[4] The morphology of its inclusion bodies, as seen in sections of mouse lungs, and of its elementary bodies, as revealed by smears of mouse lung or infected chick embryo yolk sac, relate it very definitely to the viruses of psittacosis, other ornithosis strains, lymphogranuloma venereum, meningopneumonitis, trachoma, inclusion conjunctivitis and others. Some cases of primary atypical pneumonia of man are related to agents within this group.[5]

Although the serum neutralization test is applicable to the study of most viruses, difficulty has been encountered in the use of the test in this group of agents. Repeated attempts in this laboratory to induce neutralizing antibody in the rabbit against the mouse virus have failed. In general, it has been the experience of other investigators that infection or artificial immunization of animals with these agents gives rise to neutralizing antibody only to a slight extent or not at all. Similar results have been obtained with convalescent human serums, although exceptions are found in some of the reports regarding lymphogranuloma venereum serum,[6] and in the demonstration of neutralizing antibodies in monkey and human serums after artificial immunization with psittacosis virus.[7]

TABLE 1

Comparative Serum Neutralization Tests on Rabbit and Chicken Serums

Serums	LD50*	Average infectivity scores† at virus dilutions								
		10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	10^{-8}	10^{-9}
Normal rabbit	$10^{-3.60}$	5.00	5.00	5.00	3.5	1.83	1.00	.67	.00	
Immune rabbit	$10^{-3.35}$	5.00	5.00	4.33	1.33	1.00	1.00	.00	.00	
Normal rooster	$10^{-4.50}$	4.83	4.83	5.00	5.00	3.00	1.20	1.00	.33	.00
Immune rooster	$> 10^{-1}$	2.00	1.00	1.00	.33	.00	.00	.00	.00	

Three-tenths cc volumes of the serums were added to equal amounts of virus dilutions. Infected mouse lung served as antigen in the rabbit serum test, and infected yolk sac with the rooster serum. After standing at 20° C for 1 hour, 0.03 cc from each tube was instilled intranasally into each of 6 mice. Mice were observed daily and survivors were autopsied on the 10th day.

* The 50 per cent. mortality dose computed according to the method of Reed and Muench (L. J. Reed and H. Muench, *Am. Jour. Hyg.*, 27: 493, 1938) from the record of deaths not included here.

† Computed by the method of Horsfall (F. L. Horsfall, *Jour. Exp. Med.*, 70: 209, 1939) which gives a numerical value to the amount of infection as determined by the extent of lung consolidation.

Recognizing the similarity of our mouse virus to the several strains infecting birds, we investigated the ability of chickens to produce antiserum against this virus. Repeated injection of infected mouse lung emulsion into roosters resulted in the appearance of neutralizing antibody of relatively high titer. Parallel inoculations of rabbits were made, but only traces of antibody were produced. The immunizing procedure for both species was the same and consisted of a series of 25 intraperitoneal and 3 intramuscular injections of mouse lung virus over a period of 15 weeks.

---

[1] This investigation was supported by the John Rockefeller McCormick Memorial Fund of the University of Chicago.

[2] F. B. Gordon, G. Freeman and J. M. Clampit, *Proc. Soc. Exp. Biol. and Med.*, 39: 450, 1938.

[3] H. V. Karr, *Jour. Infect. Dis.*, 72: 108, 1943.

[4] A. R. Dochez, K. C. Mills and B. Mulliken, *Proc. Soc. Exp. Biol. and Med.*, 36: 683, 1937; K. Herzberg and W. Gross, *Zentralbl. f. Bakt.* (*Abt. I*), *Orig.*, 146: 129, 1940; K. Herzberg, *ibid.*, 177, 1940; R. Goonert, *Klin. Wohnschr.*, 20: 76, 1941; C. Nigg, Science, 95: 677, 1942.

[5] T. Francis and T. P. Magill, *Jour. Exp. Med.*, 68: 147, 1938; M. D. Eaton, M. D. Beck and H. E. Pearson, *ibid.*, 73: 641, 1941; J. E. Smadel, *Jour. Clin. Invest.*, 22: 1, 1943.

[6] E. Rodaniche, *Jour. Infect. Dis.*, 66: 144, 1940.

[7] T. M. Rivers and F. E. Schwentker, *Jour. Exp. Med.*, 60: 211, 1934.

Table 1 shows the results of neutralization tests in which a specimen of serum taken after the period of immunization is compared with serum from the same animal before immunization. Considerable protection was afforded by the immune chicken serum as shown by survival of all mice (L_{D50} of virus $= > 10^{-1}$), and much less extensive lung involvement than was seen in the controls. The protective effect of immune rabbit serum was very slight.

In the tests with chicken antiserum, virus propagated in the yolk sac of the chick embryo was used instead of mouse lung virus to avoid any non-specific effects due to antibody against mouse lung tissue. However, in one test neutralization occurred to the same degree when mouse lung virus was used with the chicken antiserum, and although flocculation occurred in the tubes containing low dilutions of serum, this did not appear to influence the result of the test. No flocculation was observed when rabbit antiserum was mixed with mouse lung virus.

The results recorded in Table 1 suggest that there is a distinct advantage in using the chicken as a source of antibody against this agent. Whether this advantage is due to a greater susceptibility resulting in an unrecognized infection, or whether other factors are responsible, we do not know. Several reports[6] have appeared recently suggesting that chicken serum has certain advantages over other types of serum for various purposes.

The anti-mouse virus chicken serum reacts also with egg-propagated virus to give a visible *in vitro* flocculation. The antigen for this test was prepared by differential centrifugation of infected yolk sac emulsion. By this means the elementary bodies, which appear to constitute infectious particles of virus, may be partially purified and concentrated. Dilutions of the immune chicken serum were made and antigen added as in an ordinary bacterial agglutination test. Final dilutions of serum were from 1:4 to 1:1,024. For suspending the antigen and making dilutions of serum, saline solution lightly buffered at pH 7.0 was used. After incubation at 50° C for 12 hours, flocculation was visible in the first 5 tubes (1:4 to 1:64), with the maximum at 1:16. No flocculation appeared in a parallel series of tubes with normal chicken serum. Although the flocculated matter, when stained, was seen to contain aggregated elementary bodies, much of the floccule consisted of a more highly dispersed lightly staining material. This was always encountered during attempts at purification of elementary bodies, and its removal proved to be extremely difficult. However, by continued manipulation, a few suspensions of elementary bodies were prepared in which this more highly dispersed material was not detectable. Floccules appeared when these suspensions were mixed with the chicken antiserum on a slide, and staining of such preparations revealed the floccules to be composed only of aggregated elementary bodies. Thus, the antiserum appears to contain an agglutinin for the elementary bodies and an antibody capable of flocculating the more disperse material.

Following the demonstration that this chicken antiserum neutralized virus in the ordinary *in vitro* test, several experiments were performed to test its prophylactic and therapeutic effect on the disease in the mouse. Table 2 gives a representative protocol. A definite protective effect is evident when a single dose of serum is given either before or after the virus inoculation. Other experiments show that even a greater therapeutic effect may be obtained when several serum injections are made during the 3 days following virus inoculation.

TABLE 2

PROTECTION OF MICE AGAINST MOUSE PNEUMONITIS BY ADMINISTRATION OF IMMUNE CHICKEN SERUM AT VARYING PERIODS BEFORE AND AFTER VIRUS INOCULATION

Serum administration, 0.03 cc intranasally	Result with normal serums	Result with immune serums
6 hours before virus inoc.	4.2	1.6
1 hour before virus inoc.	4.8	1.1
1 hour after virus inoc.	4.0	3.1
1 and 3 hours after virus inoc.	4.4	2.6
4 hours after virus inoc.	4.0	2.4

Virus inoculation made intranasally with 0.03 cc emulsion of infected yolk sac. All surviving mice autopsied on 5th day. Figures represent average infectivity scores (see legend, Table 1) of 8 to 11 mice.

The successful use of the chicken for producing antibody against this agent may indicate a satisfactory method of antiserum production against other viruses of this group. Serums of good neutralizing titer or suitable for *in vitro* flocculation tests would be of great advantage in clarifying the antigenic relationships within this group. It is also possible that such serums would prove of value in treatment of human infections with these agents. Further investigation along these lines is under way.

MAURICE R. HILLEMAN
F. B. GORDON
DEPARTMENT OF BACTERIOLOGY
AND PARASITOLOGY,
UNIVERSITY OF CHICAGO

ATTEMPTS TO PROTECT AGAINST INFLUENZA VIRUS WITH VARIOUS SULFONAMIDES, ACRIDINES AND ANTIBIOTICS[1]

SEVERAL sulfonamides, acridines and antibiotics have been tested in this laboratory to determine their effectiveness in conferring protection against influenza virus. It has been reported by other workers that certain sulfonamides used in conjunction with azochloramide,[2, 3, 4] pyridium[5] or neoarsphenamine[6] against bacteria gave better results than when either compound alone was used. Accordingly, experiments were conducted to determine if the same combinations would prove effective against influenza virus, although it has already been demonstrated that many sulfonamides,[7, 8] some acridines[8] and penicillin[8] administered alone were ineffective as protective agents.

---

[6] H. R. Wolfe, *Jour. Immunol.*, 44: 135, 1942; J. J. Phair, D. G. Smith and C. M. Root, *Proc. Soc. Exp. Biol. and Med.*, 52: 72, 1943; N. P. Hudson, S. M. Michael and F. S. Markham, *Jour. Exp. Med.*, 77: 467, 1943.

[1] The opinions advanced in this publication are those of

The PR–8 strain of influenza A virus was used throughout our experiments. Each sulfonamide listed below was tested alone and in combination with azochloramide, pyridium and neoarsphenamine. Two procedures were followed:

(1) Equal volumes of drug solution and mouse lung virus suspension were mixed so that the final concentration of virus was 10 MLD/0.05 cc. The mixture was then held at refrigerator temperature (4° C.) for 2 hours, after which period 0.05 cc was inoculated intranasally into each of six white mice.

(2) Daily intraperitoneal injections of the compound under test were given to white mice for a period of 12 days. On the second day of the series each animal received an intranasal inoculation of 0.05 cc of mouse lung virus suspension containing 10 MLD's. Those animals which died during a 10-day period of observation were immediately autopsied. If more than one half of the total lung tissue was consolidated the mice were considered to have died from influenzal infection. On the 10th day after intranasal inoculation of virus all surviving mice were sacrificed and the extent of pulmonary consolidation recorded.

The following compounds were studied:

SULFONAMIDES

Drug	Dosage Administered Daily (contained in 0.2 cc)
1. Sulfanilamide	1 mg
2. Sulfathiazole	1 mg
3. Sulfapyridine	1 mg
4. Sulfadiazine	1 mg
5. Benzenesulfamido-m-ethylphenol[9]	4 mg
6. 2-amino-5-azobenzenesulfonamido-pyridine[9]	4 mg
7. Carbonyldisulfanilamide[9]	3 mg
8. Thionyldisulfanilamide[9]	4 mg
9. Azobenzenesulfonamidotrypaflavine hydrochloride[9]	1 mg
10. 2-ethoxy-6,9-diaminoazobenzene-sulfonamido-acridine[9]	1 mg
11. Caproyl-p-benzenesulfonamide[9]	4 mg
12. Caproaldehydosulfonamide[9]	4 mg
13. O-hydroxybenzyl-p-aminobenzene-sulfonamide[9]	4 mg
14. Sulfuramine[9]	1 mg
15. 2-ethoxy-6,9-diaminobenzeneamido-thiazol-acridine[9]	4 mg

ACRIDINES

1. Trypaflavine[9]	2 mg
2. Proflavinehydrochloride[9]	2 mg
3. Rivanol[9]	2 mg

ANTIBIOTICS

1. Penicillin[10]	5 mg (650 Oxford Units)
2. Tyrothricin[11]	5 mg
3. Tyrocidin[11]	5 mg
4. Gramicidin[11]	5 mg
5. Subtilin[11]	5 mg

OTHER COMPOUNDS

1. Azochloramid	0.02 mg
2. Pyridium	0.02 mg
3. Neoarsphenamine	0.001 mg

None of the compounds tested under the conditions of these experiments, alone or in combination, was effective in preventing influenzal infection in mice.

THE PERSONNEL OF NAVAL LABORATORY
RESEARCH UNIT NO. 1[12]

BERKELEY, CALIF.

---

the writers and do not represent the official views of the Navy Department.

[2] E. Neter, *Jour. Pharm. and Exp. Therap.*, 74: 52, 1942.

[3] F. C. Schmelkes and O. Wyss, *Proc. Soc. Exp. Biol. and Med.*, 49: 263, 1942.

[4] E. Neter, *Proc. Soc. Exp. Biol. and Med.*, 47: 303, 1941.

[5] E. Neter, *Urol. and Cutan. Rev.*, 45: 295, 1941.

[6] E. E. Osgood, I. E. Brownlee and J. Joski, *Am. Jour. Med. Sci.*, 200: 596, 1940.

[7] L. T. Coggeshall and J. Maier, *Jour. Pharm. and Exp. Therap.*, 76: 161, 1942.

[8] C. H. Andrewes, H. King and M. van den Ende, *Jour. Path. and Bact.*, 55: 173, 1943.

[9] Obtained from Dr. Frederick Proescher, pathologist, Santa Clara Hospital, San Jose, California.

[10] Obtained from Merck and Company, Rahway, N. J.

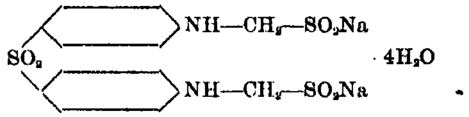
[11] Obtained from the Western Regional Research Laboratory of the Agricultural Research Administration, Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture.

[12] The Unit Personnel consists of the following members of the U. S. Naval Reserve: A. P. Krueger, Captain, MC-V(S), officer-in-charge; Lieutenants H. W. Bischoff, MC-V(S), A. S. Browne, H-V(S), O. J. Golub, H-V(S), A. H. Jacobs, MC-V(S), L. E. Rosenberg, H-V(S) and N. S. West, H-V(S); Lieutenants (jg) J. R. Mathews, H-V(S), M. D. Thaxter, HC-V(S) and H. M. S. Watkins, H-V(S); Ensigns A. J. Glazko, H-V(S) and G. B. Saviers, HC-V(S); Pharmacist I. L. Shechmeister, HC-V(S); Chief Pharmacist Mate W. L. Axelrod; Pharmacist Mates First Class E. R. Chisholm, C. R. Webb, Jr., and H. R. Burkhead; Pharmacist Mate Second Class W. D. Won; Hospital Apprentice First Class D. L. Jones and R. R. Muth; and Hospital Apprentice First Class A. D. Dolan, Jr., of the U. S. Navy.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

DIASONE. A NEW AND ACTIVE CHEMOTHERAPEUTIC AGENT

Disodium formaldehyde sulfoxylate diaminodiphenylsulfone, designated as Diasone, has the following chemical structure:



It was synthesized by us in 1937.[1, 2] Diasone is water soluble, forming fairly concentrated solutions, stabilized by the addition of small quantities of sodium bicarbonate. For years the writer was interested in the detoxifying effect of sodium formaldehyde sulfoxylate upon arsphenamine,[3] the toxicity of which was greatly diminished without proportionate reduction of the therapeutic effect. In other words, the ratio of $\frac{\text{maximum tolerated dose}}{\text{minimum therapeutic dose}}$ was shifted in favor of neoarsphenamine, which is a sodium formaldehyde sulfoxylate derivative of arsphenamine. This has been conspicuously demonstrated in rat trypanosomiasis, rabbit syphilis and human syphilis.

We found that the same improvement in the ratio $\frac{\text{maximum tolerated dose}}{\text{minimum therapeutic dose}}$ occurred when we combined 4,4′-diaminodiphenylsulfone with sodium formaldehyde sulfoxylate. The reduction in toxicity was found to be most impressive. The diaminodiphenylsulfone is known to be toxic to mice, which tolerate at most a single oral dose of 0.200 gms per kilogram of body weight.[4] The maximum tolerated dose of Diasone given to mice by mouth is much larger, namely 4 grams. Rats tolerate a single dose of 7 grams per kilo and rabbits 3½ grams per kilo. Dogs 30 to 40 pounds in weight which were given 60 consecutive daily doses of 1 gram each tolerated the drug without loss in weight or any visible disturbance.

As to the therapeutic efficiency, we found that mice, infected with the streptococcus hemolytic strain C 203 and treated with Diasone by the drug food method, were cured—the drug proving to be as effective as sulfanilamide. In similar experiments, performed on mice infected with pneumococcus type II, Diasone appeared to be almost as effective as sulfadiazine.

The most important therapeutic property of this chemical compound, however, manifests itself in experimental tuberculosis. Since 1938,[5] various investigators became interested in sulfanilamide in the treatment of tuberculosis in guinea pigs. Feldman and Hinshaw[6] extended this observation to sulfapyridine and finally to a derivative of diaminodiphenylsulfone, known as Promin.[7] Callomon[8] found Diasone to be decidedly less toxic than Promin. When mortality and histological changes due to tuberculosis in guinea pigs were considered, Diasone produced the most beneficial therapeutic results among various compounds administered, including Promin. Feldman, Hinshaw and Moses[9] also found Diasone to be an effective therapeutic agent in experimental tuberculosis.

With its background of low toxicity and effectiveness in experimental infection, this drug gives promise of favorable clinical application in tuberculosis.

George W. Raiziss
Dermatological Research Laboratories,
Philadelphia, Division of Abbott Laboratories, North Chicago, Ill.

---

[1] The chemistry of Diasone is described in a paper by G. W. Raiziss, R. Clemence and M. Freifelder, entitled "Synthesis and Chemical Properties of Diasone." To be published.

[2] A similar product was simultaneously and independently prepared, using a different method, by H. Bauer and S. M. Rosenthal, "Studies in Chemotherapy" VII. Some new sulphur compounds active against bacterial infections, *Pub. Health Rep.*, 53: 40, 1938.

[3] G. W. Raiziss, J. F. Schamberg and J. A. Kolmer, *Proc. Soc. Exp. Biol. and Med.*, 5: 18, 1921. G. W. Raiziss and M. Falkov, *Jour. Biol. Chem.*, 5: 46, March, 1921.

[4] G. W. Raiziss, M. Severac and J. Moetsch, "The Toxicity and Therapeutic Effectiveness of Diasone." To be published.

[5] G. A. H. Buttle and H. J. Parish, "Treatment of Tuberculosis in Guinea Pigs with Sulphanilamide," *Brit. M. J.*, 2: 776, 1938.

[6] W. H. Feldman and H. C. Hinshaw, *Proc. Staff Meet. Mayo Clin.*, 14: 174, 1939.

[7] W. H. Feldman, H. C. Hinshaw and H. E. Moses, *Proc. Staff Meet. Mayo Clin.*, 15: 695, 1940; 16: 187, 1941.

[8] F. F. T. Callomon, *Am. Rev. Tuberculosis*, 52: 1, January, 1943.

[9] W. H. Feldman, H. C. Hinshaw and H. E. Moses, *Arch. of Pathology*, 36: 64–73, July, 1943.

BOOKS RECEIVED

Fernald, Merritt Lyndon and Alfred Charles Kinsey. *Edible Wild Plants of Eastern North America.* Illustrated. Pp. xiv + 452. Idlewild Press. $3.00.

Hoerr, Normand L. *Frontiers in Cytochemistry.* Biological Symposia, Volume X. Illustrated. Pp. vii + 334. The Jaques Cattell Press. $3.50.

Kolthoff, I. M. and E. B. Sandell. *Textbook of Quantitative Inorganic Analysis.* Illustrated. Pp. xvii + 794. The Macmillan Company. $4.50.

Remick, A. E. *Electronic Interpretations of Organic Chemistry.* Illustrated. Pp. v + 474. John Wiley and Sons. $4.50.

Shand, S. James. *Eruptive Rocks. Their Genesis, Composition, and Classification, with a Chapter on Meteorites.* Illustrated. Pp. xvi + 444. John Wiley and Sons. $5.00.

Trewartha, Glenn T. *An Introduction to Weather and Climate.* Illustrated. Pp. xi + 545. McGraw-Hill Book Company. $4.00.

SCIENCE

VOL. 98 FRIDAY, OCTOBER 22, 1943 No. 2547

Minerals' Share in the War: D. N. WADIA 351

Obituary:
John Otterbein Snyder: DR. WILLIS H. RICH. *Deaths and Memorials* 356

Scientific Events:
The Academy of Sciences of the U.S.S.R.; Limitation Order L-144; Mellon Institute Technochemical Lectures, 1943-44; The Director of Research of the Wellcome Foundation; The American-Soviet Scientific Congress; Centennial of the Observatory of the University of Cincinnati 357

Scientific Notes and News 360

Discussion:
Elements of the Generality of the Group Concept: DR. G. A. MILLER. *Protein Concentrates from Grasses:* DR. J. T. SULLIVAN. *Why the Kilgore Bill?:* DR. HARLAN T. STETSON 362

Scientific Books:
Cytology: PROFESSOR FRANZ SCHRADER. *Quantitative Analysis:* DR. FREDERICK R. DUKE. *The Chemical Formulary:* PROFESSOR W. D. TURNER 365

Special Articles:
Influence of Adrenal Cortical Secretion on Blood Elements: DR. THOMAS F. DOUGHERTY and DR. ABRAHAM WHITE. *The Natural Occurrence of Riboflavin Deficiency in the Eyes of Dogs:* DR. TOM D. SPIES 367

Scientific Apparatus and Laboratory Methods:
Identity of a Lethal Agent in Broth Filtrates of Hemolytic Streptococci with Erythrogenic Toxin: GEORGE E. FOLEY. *Deantigenated Beef Blood Plasma as a Possible Substitute for Human Blood Plasma:* DR. JULIAN H. LEWIS 370

Science News 8

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

MINERALS' SHARE IN THE WAR[1]

By D. N. WADIA

THE Indian Science Congress meets to-day for the fourth time since the beginning of the war. This meeting, only a few hundred miles remote from one potentially active war theater, is an event which bears significant testimony to the place science has won in India. The attendance of so many members drawn from many fields of scientific activities and Government institutions from almost all parts of the country, provides gratifying proof of their devotion to the cause of science and of their subscribing to its exacting ideals. Calcutta has once again made its contribution to the spread of science in India by inviting the congress for the sixth time. We keenly appreciate the warm hospitality it has accorded us under conditions of difficulty we all realize, and it is no mere formal expression of thanks that in your name and on your behalf, I tender to the organizers of this session. A distinguished citizen of India was to have presided at this meeting and no one here shares, more keenly than I, in the disappointment at his absence to-day. I seek your forbearance at my having to address you because of an existing rule which requires your president of the foregoing year to continue in office until its assumption by his successor. Pandit Jawaharlal Nehru's contributions to science in India have not been in the limelight, but they have been a leavening influence in the organization and working of the National Planning Committee, which, since 1939, is engaged in the great task of coordinating applied science with productive industry in every field, industrial, educational, cultural and organizational. Ladies and gentlemen, please believe me, I sympathize with you for having missed his rousing address.

Death has removed from our midst during the year several distinguished workers in different fields of science. The Indian Science Congress mourns the deaths of Rai Bahadur Ramprasad Chanda, anthropologist, archeologist and student of Indian art; Rai Bahadur Sarat Chandra Ray, Tibetan scholar, archeologist and founder-editor of *Man in India;* Mr. Gauripati Chatterjee, meteorologist, distinguished for aerological researches in upper air; Dr. G. de P. Cotter, late of the Geological Survey of India and a past president of the Section of Geology; Colonel Sir Francis Younghusband, reputed soldier, Central Asian explorer, geographer and a close student of Indian philosophy.

---

[1] General presidential address before the Thirtieth Indian Science Congress, Calcutta, 1943.

Reviewing the events of the year that has passed, the most outstanding and dominating event was the approach of the war to the doors of India. For the first time in the 4 millenniums of recorded Indian history, the enemy has assaulted the Eastern frontiers of the country. By sea, land and air our 2,000 miles long eastern walls have been approached and threatened by the invading enemy. But equally significant in the annals of 1942 was India's answer to the invaders, the answer conveyed through its munitions factories, electric, chemical and the host of technical plants, industrial research laboratories and the hundreds of young university-trained men manning engineering, medical, naval and air corps during the year. This may truly be regarded as the greatest event of the last few years in the cultural life of the country—for the first time after her age-long belief in the force of philosophic and spiritual striving as the goal of life, India has taken up the challenge of science and the machine and is adjusting itself intelligently and conscientiously and with surprising quickness to compose a society in which striving for both material and spiritual well-being are equally regarded as ruling factors in a perfect life. That indeed is an ideal difficult to achieve for any people, but in present-day India the change-over is taking place at a remarkably accelerating pace. Indian scientists by their last thirty years' work in different branches of science have made a notable contribution towards fostering the new mental attitude which has brought about this difficult welding. Lord Linlithgow happily expressed the need of such welding for the people of the East as well as the West in his opening address before the Jubilee Session of the Indian Science Congress held in Calcutta in 1938. "Even the most enthusiastic believer in Western civilization must feel to-day a certain despondency at the present failure of the West to dominate its scientific discoveries and to evolve a form of society in which the material progress and spiritual freedom march comfortably together. Perhaps the West will find in India's more general emphasis on simplicity and the ultimate spirituality of things, a more positive example of the truths which the most advanced thinkers of the world are now discovering." To this consummation philosophy and science must aim if the one is not to end in ultimate futility after ages of persistent effort and the other not to achieve, as a reward of its magnificent discoveries and inventions and its conquests over nature, a barren desert of frustration through a succession of world wars.

Minerals' Share in War

A geologist's work during war time is largely mobilizing all mineral resources in his own limited sphere for munitions purposes. Free international movement of minerals having ceased, every country has to produce the full quota from its domestic mineral resources. Far-reaching questions will arise in the near future, if indeed some have not already arisen, as to how long minerals from accessible depths of the earth will be able to sustain man's wars.

Man's advancement to civilization from the hunter and peasant stage is due to his mastery over metals and minerals, but this advance has caused most serious inroads on the world's stock of minerals and especially of metals. During the century and quarter between the Napoleonic wars and the Hitlerian war, the consumption of minerals has been over a hundred-fold of that consumed during the entire history of man on earth and so far as metals are concerned, man has used up between 1914 and to-day, between the two German wars, more metals than during any previous period of history. Metals such as tin have almost reached depletion stage, silver is being made to stand substitute for tin, while the extractable stock of platinum, silver and gold left for future needs of the world within manageable depth will be very meager. The consumption of fossil fuels, coal and petroleum has been at a far more serious rate, so serious that the world's known reserves of mineral oil at the present rate of production will be exhausted in a few decades. The total world coal reserves are larger, but they will last only a few decades longer, if the present acceleration of production and consumption of coal and its use for the ever-lengthening catalogue of by-products continues in the future at the same rate. So far no checks have been devised for this alarming depletion of the world's underground wealth, and this robbing of the earth by the living generation at the expense of future generations. Metals and minerals are a rapidly wasting asset of a country for which there is no renewal or replacement. Agricultural and forest resources of a land can be rejuvenated by suitable measures and manures, but no fertilizer can revive one exhausted mine, for geological processes are exceedingly slow, requiring hundreds of thousands of years to form a vein of metallic ore or a bed of coal.

There are some 1,500 distinct species of minerals known; of these about 200 find application in commerce and industry and are considered economic minerals. Among these again there is a rapidly mounting list of metals and minerals which are of vital use in the manufacture of munitions of war and of highly specialized commodities of strategic use. In the defence program of a nation under the present-day conditions of totalitarian warfare, the metallurgical industry and its ancillary mining of minerals yielding the ferrous and alloy metals, fluxes, refractories and accessory minerals are of essential importance. A significant feature of the distribution of these minerals is the concentration of their production and manufacture in a comparatively few countries in the world, happily nearly three fourths of these being centered in, or controlled by, the United Nations as against the Axis group. Of the total annual mineral production of the world in pre-war years as much as 85 per cent. came from North America and Western Europe, of these the United States, England and Germany and latterly Russia contributing over 75 per cent. This, however, does not mean that nature has endowed these countries to this unequal extent with valuable minerals; it rather is an index of the country's industrial and technical development and the energy of the people. Russia's three successive five-year plans are an example of this. Industrial progress of other parts of the world [illegible] materially change this condition. For instance, China's vast reserves of coal, hitherto untapped for lack of economic employment, may, in the not distant future, be put to use in metallurgy, or in the production of heat energy or other profitable channels. India's resources in iron-ore are of a magnitude quite out of proportion to the bare couple of million tons of pig iron per year it has only recently begun to produce. Only in a few districts of Bihar and Eastern States Agency, the high-grade iron-ore reserves are calculated to be of the order of 4,000 million tons. Large reserves of aluminium-ore are still only potential assets. The minerals of South America and Africa are yet in an early stage of development, while Australia's store of mineral wealth is yet unknown over wide tracts of that region. When these untouched reserves enter production stage, the apparent inequalities will diminish and the countries bordering the North Atlantic basin will not occupy the dominating position in strategic minerals they do at present.

But even so, when the whole world's mineral resources are fully known and mobilized, the stock will not last many generations, if it is made to feed the waste of recurring wars on the scale of magnitude and frequency of the last two world wars. If the supply and free movement of a few ferro-alloys and a few strategic key minerals for non-industrial uses is controlled by some central world organization, the demon of totalitarian war can be banished and the remaining wars shorn of their insane waste involved in military as well as non-military devastations. Then the wreckage of tanks and armor-plates can be beaten back into ploughshares and its superior steel released for beneficent uses in peace.

It is no exaggeration to say that half of the later wars of history have been directly or indirectly motivated through the desire of gaining access to stores of strategic mineral products, ores, fuels, salts, alloy metals and essential industrial minerals.

The international mineral situation during pre-war years was in a chaotic state. While the United Nations were in a state of "vacuous unawareness" about it, the Axis powers grabbed as much of the indispensable munitions minerals as they wanted and the war has been waged by them on the stores of hoarded minerals and metals.

Only the adoption of a wise and justly planned international mineral policy framed by an international directorate can preserve peace and goodwill amongst countries unequally endowed by nature with mineral wealth. No country in the world, however well supplied it be, is self-sufficient in mineral requirements, nor is any so situated that it can regard its mineral resources as purely domestic or national. Embargoes, tariffs, patent rights and transport controls imposed for political reasons do not offer a solution, but by hindering free movement of minerals become powerful contributive factors in precipitating world wars. Unequal geographical distribution of minerals being an unalterable fact, planned international economy should devise means not only to eliminate this cause of inter-country friction but to increase the interdependence of nations on each other for their vital trades and industrial needs and so make minerals a rallying point for international cooperation and goodwill. The preliminary recommendations of the Conference on Mineral Resources and the Atlantic Charter convened by the British Association's Committee on Social and International Relations of Science last July, appear to be on the right lines, but they will not go far enough if their implications are meant to safeguard the interests of the British Empire only, or even of the whole United Nations' group. These should embrace all the free countries and should call for sacrifice from all participating nations of part of their national and natural advantages for the ultimate benefit of all and the future security of the peoples of the world. The main resolution of this conference reads as follows:

> This Conference, having specifically dealt with mineral resources, submits that, as a first step, the Council should initiate forthwith consultations with appropriate scientific and technical organizations, to secure an understanding on the principles involved. The Conference would further urge that a scientific review of mineral resources, using and supplementing all existing data, should be among the first tasks of any international organization for the social applications of science, such as was envisaged at the recent Conference on Science and World Order. To this end, the Conference recommends that the Council should consider how it might help

to promote the establishment of an International Resources Organization, as a fact-finding and advisory body for Governments, as a contribution to world stability, and in the spirit of the Atlantic Charter.

The fourth article of the Atlantic Charter postulates access for all states on equal terms to the raw materials of the world. But if the Atlantic Charter does not unreservedly provide for all peace-loving nations of the earth, whatever oceans bound them, its fulfilment in a partial degree will not achieve the goal of post-war minerals allocation, nor succeed in removing a focal infection point in the body politic of the world.

The position of mineral affairs to-day being what it is, it behoves us as non-Utopian science workers to ask—what is India's place in the world's mineral map? The mineral outlook of the Indian region is on the whole satisfactory both for war and peace-time requirements. India's resources in minerals of strategic importance, minerals for munitions and defence armaments, base metals, alloys, fluxes, refractories and accessory minerals can be regarded as adequate, in several but not all of them. India is deficient in tin, tungsten, lead, zinc, nickel, graphite and liquid fuels. But in the basic metals, iron, manganese, aluminium and chromium, the country is well supplied, in the case of the former three, in large excess. Our neighbor, Burma, has abundant stocks of the munition metals of which India is in defect, while her oil resources must yet be regarded as considerable. Ceylon has reserves of the world's finest graphite, a mineral indispensable in metallurgy and of a magnitude sufficient to last a long period. Ancillary minerals such as asbestos, cement, fertilizers, clays, mica, sulphur, various salts, ores and other minerals of industrial utility are available in quantities sufficient for the country's needs, while some are in exportable surpluses.

The experience of the last three years' war effort in the production in India of a wide range of munitions, without any previous apprenticeship, is satisfactory proof of the country's adequacy in some respects, though still unequipped in a number of essentials, *viz.*, specialized steels, machine tools, manufacture of aircraft, high explosives, automobile engines, big ship construction, etc., on a scale commensurate with her internal requirements.

THE SOCIAL OBLIGATIONS AND RELATIONS OF SCIENCE IN INDIA

Last year, while addressing you on the progress of the exact sciences in India during the last 30 years, I stated that the retrospect was satisfying and held out promise of further developments. The time, however, has come, and the events of the last few years forcibly remind us of the fact that science, as pursued in the laboratory and the field, is becoming more and more a specialist's job and is becoming divorced from the life of the people. Science, as applied to the problem of daily living and the social needs of the common man, is the great necessity of the day. The advent of the motor bus, the radio and railway engine in the villages of India is not the same thing as bringing science to the homes of our villagers. The impact of science on the Indian masses has come in the form of a rather rude intrusion of machines and mechanics into the essentially simple rural economy of the country and it is not surprising that this meeting has not been a particularly happy one. It has disturbed the economic structure and created, if not some aversion, an indifference to the cult of science in the popular mind. But we all know that science is not all mechanics nor are its practical uses to man the greatest thing about science. The greatest thing about science is the scientific method—the most effective thing man has for discovering truth and the ways of nature. It can bring solid benefits by releasing life from stagnation and the bonds of ignorance wherever these prevail, whether in cities or in the country-side, among the laboring masses or among the governing class. The awakening to the social obligations of science is of recent date and even in Europe and America, this aspect of the cultivation of science was for long not realized and left to sporadic individual efforts. With this awakening, a two-fold problem faces science all over the world to-day—to press the newest discoveries and inventions of applied science into the service of agriculture, manufactories, hospitals, homes and schools and alongside with it to so control the impact of these on his private life that his mechanized work-a-day life may not be totally divested of all higher spiritual values. Our future national life and its material well-being largely depend on a wholesome balance being maintained between these two—the impulse to harness science to increase physical comforts of life and a restraining desire to preserve the old-world spiritual calm and simplicity of living. Happily for India, this balancing is somewhat of a natural hereditary trait and does not need much emphasis. While in the European countries the evolving of a true synthesis, a *via media,* demands much searching and learned arguing, our age-old traditions have made this work easier. India's late start in the application of science to industry also gives it an opportunity of planning along right lines. The significance of this problem has been realized by both our political leaders, as well as scientists, and some progress is made in this direction. I refer to the inauguration in 1939 of the National Planning Committee under the chairmanship of Pandit Jawaharlal Nehru, with the specific object of coordinating science with industry in all its phases and to the establishment by the Indian Science Congress at its Lahore session in January, 1939, of a subcommittee on science and social relations, mainly with the object of studying the influence of science on India and collecting data relating to the effects of science on society in India.

The National Planning Committee, through its 29 subcommittees, has set out on formulating a program covering many phases of the country's future life and activities, material, productive, educational, artistic. Their work unfortunately is in a great measure suspended to-day, though some of the 29 subcommittees have furnished more or less complete, well-documented reports, while others have submitted interim fact-finding reports. Their conclusions, doubtless, will be subjected to thorough revision and deliberation by the main body which comprises 200 of the leading industrialists, publicists and scientists of the country, before they are offered to the public, but a great deal of spade work is accomplished, a valuable mass of ascertained classified details collected and many blueprints prepared. A planned reconstruction in a greater or less measure of India's commerce, industry, finance, land labor, mining, transport, power-generation, technology alongside educational, cultural and social reorganization is expected to emerge from the labors of this body.

PROPOSED ACADEMY OF SOCIAL SCIENCES FOR INDIA

The executive committee of the Indian Science Congress has before it a proposal for the institution of a National Academy of Social Sciences drawn up by the subcommittee on science and social relations. It is interesting to trace the origin of this subcommittee which goes back to the Blackpool meeting of the British Association for the Advancement of Science in 1936, which meeting was devoted to the discussion of the social relations of science. In the following year, a few leading science associations took cognizance of this subject. The International Council of Scientific Unions, with its headquarters at Delft, Holland, at its meeting held in April, 1937, in London, established a Committee on Science and Social Relations with Professor F. G. M. Stratton, of Cambridge University, as president. This action of European scientists was followed by a resolution passed by the American Association for the Advancement of Science at its meeting in 1937 urging the various scientific organizations of the world to reundertake examination of the profound charges brought about by science in human society and thus be in a position to promote "peace among nations and intellectual freedom in order that science may continue to advance and spread more abundantly its benefits to all mankind." In 1938 the British Association at its meeting held at Cambridge brought into being a special Division for Social and International Relations of Science with Sir Richard Gregory as its chairman. This division organized a conference on "Science and the New World Order" in London during September, 1941. In conjunction with these sister organizations of Europe and America, the Indian Science Congress instituted a subcommittee on science and social relations at its annual session held in Lahore in January, 1939. This subcommittee has been working for the last three years and its labors have fructified in the above proposal which in due course will come before the Indian scientists and to which they will have to give their most careful consideration.

The proposed academy should be a body of high academic standing and professional knowledge, which can take up long-range problems of social well-being of the people or India which the older societies and associations, established along familiar but too general lines in some cases and rather over-specialized lines in others, can not deal with without suspicion of religious or political bias. Socio-medical and political subjects, human relations, anthropology, political science, vital statistics, social biology, population problems, sociological research in particular bearing on various Indian communities are the subjects on which such an academy can work in collaboration with the Indian Science Congress and half a dozen other institutions already existing in the country for some of the above-named specific objects. It can be a living organ in the body politic of India for voicing the collective opinion and focussing the specialized points of view of numerous isolated working bodies on the one problem how to promote the well-being of the common man. The subcommittee has begun a survey of the status of sociological studies in all the Indian universities. Vice-chancellors of many Indian universities have endorsed the proposal about the academy favorably, and the secretaries of those learned societies that have been approached have announced their readiness to cooperate. Dr. K. Motwani, the secretary of the subcommittee, personally placed the scheme before Pandit Nehru last July and, in accordance with Pandit Nehru's wishes, the executive committee proposes to appoint a committee of experts to suggest ways and means of bringing this academy of social sciences into being. The matter rests here. It is too early to outline the exact task to which the academy will address itself. Its chief function will be to explore those avenues through which the contributions of science may be adapted to the life of the individual and the nation without allowing any anti-social applications of science such as have made a shambles of so many countries, ever raising their heads in our midst. Secondly, the academy should emphasize an integrated, synthetic approach to every problem, pressing into service the contributions of various basic social sciences such as human geography, anthropology, psychology, economics, political science, philosophy and sociology. The bringing into being of a national academy so constituted may well become a crowning achievement of the Indian Science Congress.

OBITUARY

JOHN OTTERBEIN SNYDER

DR. JOHN OTTERBEIN SNYDER, professor of zoology, emeritus, at Stanford University, died in Palo Alto, California, on August 20, 1943. Professor Snyder was born in Butler, Indiana, on August 14, 1867. He is survived by his wife, the former Frances Hamilton, and two children, Corporal Cedric O. Snyder, U. S. Medical Corps, and Evelyn Hamilton Snyder, of Palo Alto.

Professor Snyder's boyhood was spent in the town of his birth, where he received his early education. In 1890 he went to Indiana University. There, as a freshman, he came under the stimulating influence of the late Dr. David Starr Jordan, became interested in the study of fishes and followed Dr. Jordan to Stanford in 1892. From that time until his death he was closely associated with the Stanford community, first as student, later as teacher, administrator and citizen. In each role he played a leading part.

From the year before his retirement from the university (1931) to 1937 Professor Snyder was director of the Bureau of Fish Conservation of the California Division of Fish and Game. His understanding of the fundamental biology involved and his genius for organization resulted in a complete revision of the work of that bureau along scientific lines. On retirement from the service of the state, he left the administration of the bureau in the hands of a former graduate student whom he had selected and trained especially for that work.

Professor Snyder's more serious research interests were broadly in the field of ichthyology; he was the author of many papers dealing with systematic ichthyology, with the distribution and life histories of fresh-water fishes and with fisheries biology. In his systematic work he was especially interested in the finer differences shown by closely related forms, and in some of his earlier papers he developed methods for studying series of specimens that foreshadowed the present statistical approach to similar problems. His studies of the salmon of California were of special importance in providing a scientific background for his conservation work with the California Division of Fish and Game.

As a young man Professor Snyder took part, as ichthyologist, in a number of important scientific expeditions. He accompanied Dr. Jordan on trips to Mexico, Hawaii and Japan, and served as naturalist on the U. S. Fish Commission research vessel *Albatross* at various times between 1902 and 1906. Until 1916, he was at frequent intervals associated as assistant with the Fish Commission and with the succeeding Bureau of Fisheries. In 1914 and 1915 he served as ichthyologist in the U. S. National Museum and in 1925 was appointed director of the Marine Biological Laboratory of the Bureau of Fisheries at Woods Hole, Massachusetts. He was an active member of the California Academy of Sciences and was corresponding secretary for a number of years beginning in 1920. Professor Snyder was always keenly interested in the general welfare of the communities in which he lived. At Stanford University he served actively on various academic committees. He was a member of the city council of Palo Alto from 1917 to 1922. During World War I he quietly rendered services to the nation that were known only to a limited number of close associates.

As a youth, J. O. Snyder was widely interested in nature—in the geology and biology of his native Indiana. This interest sharpened his naturally keen powers of observation, and he developed into a superb field naturalist. This interest in the things of out-of-doors he retained throughout life. During the years of his teaching at Stanford his courses in ornithology, always popular with students, provided for many of them a source of pleasure that carried over into their lives long after their leaving the university.

His understanding of, and helpful interest in, the younger men and women who came under his influence were conspicuous traits of his character and inspired many of his students to an abiding interest in biology. It was characteristic of these interests that he regularly organized field expeditions, many of which lasted for several months, and on which he took one or more younger men. His methods in the field were systematic, thorough and ingenious, and his field notes were models of accurate observation and careful recording. The training he gave on those trips, chiefly by example, was incomparable. And training apart, the delightful comradeship and the refreshment of those days in the open with "J. O." has remained a high light in the lives of many of the students who were privileged to experience them.

WILLIS H. RICH

STANFORD UNIVERSITY

DEATHS AND MEMORIALS

Dr. Elmer Darwin Ball, dean of the College of Agriculture and director of the Agriculture Experiment Station of the University of Arizona, who was on leave of absence on account of illness, died on October 5 at the age of seventy-three years.

Gustave Samuel Lindgren, director of the U. S. Weather Bureau at Albany from 1926 to 1940, died on October 13. He was seventy-one years old.

Samuel Harden Church, since 1914 president of the Carnegie Institute, died on October 11 at the age of eighty-five years.

Dr. Max Wertheimer, psychologist, member of the graduate faculty of political and social science of the New School for Social Research, died on October 12 at the age of sixty-three years. He had been professor of psychology and philosophy at the University of Berlin and the University of Frankfort. He left Germany in 1933 after Hitler seized power and a few weeks before the dismissal of Jews from the universities began.

Dr. Cecil Rowntree, British surgeon and vice-president of the International Union Against Cancer, died on October 14. He was sixty-three years old.

The death on October 5 at the age of sixty-one years is announced of Dr. Walter Medley Tattersall, professor of zoology at South Wales and Monmouthshire University College at Cardiff.

Dr. Pieter Zeeman, until his retirement professor of physics and director of the Institute of Physics at the University of Amsterdam, died on October 9 at the age of seventy-eight years.

The fifth in the series of oil paintings designed as a monument to American medical pioneers and sponsored by Frank F. Law, president of John Wyeth and Brother, will be unveiled in Philadelphia on November 5 during National Pharmacy Week. The painting is a tribute to William Procter, Jr., American pharmacist known for his work for drug standardization. The official title of the painting is "The Father of American Pharmacy."

SCIENTIFIC EVENTS

THE ACADEMY OF SCIENCES OF THE U.S.S.R.

The Academy of Sciences of the U.S.S.R. opened its general session on September 25. In an interview, Vladimir Komarov, president of the academy, made a statement, which reads in part as follows:

> From the very beginning of the Patriotic War the Academy of Sciences of the U.S.S.R. adapted its work to the demands of the front. The attention of scientists was directed toward coordinating the problems on which they were working with the needs of the country's defense and the national economy.
>
> The presidium of the academy organized committees for mobilizing the resources of the Urals, Western Siberia, Kazakhstan and the Volga and Arctic regions, a committee to locate reserves and a committee for geological and geographical aid to the Red Army. The work of these committees had considerable practical results. In order to establish closer contact with industry, institutes of the academy allocated their scientific workers among various industrial enterprises. Great attention was paid to utilizing in production the results of completed research.
>
> The Academy of Sciences of the U.S.S.R. is working on problems connected with the re-establishment of economic life in areas freed from the German occupationists. The Mining Institute has practically completed technical plans for restoration of the productive power of the Donets and Moscow coal basins. The Institute of Geological Sciences has drawn up a report on the geophysics of the Donbas, pointing out new areas which may be explored and exploited. The Institute of Metallurgy has solved a number of problems connected with the rebuilding of the metallurgical industry in the south and the obtaining of new raw materials. The institute's researches deal with the setting up of open-hearth steel-smelting, rolling and pipe-rolling processes and the production of steel alloys. Scientists in the field of transport have worked out problems affecting the restoration and development of railroads and other means of transportation.
>
> The division of biological sciences has devoted considerable attention to improving medical and sanitary work in the Red Army and the rear. Effective methods have been developed for dealing with various complications arising from wounds such as shock, hemorrhage and nervous reaction.
>
> In the first half of the current year 154 scientific studies were completed in various divisions of the academy. The Government has marked the scientific activity of many of the academy members. Academicians A. N. Krylov and N. N. Burdenko were honored with the title of Hero of Socialist Labor. Stalin prizes were awarded this year to 32 academicians, 11 corresponding members and 13 professors and research workers of the academy.
>
> At this general session of the academy a report was made on scientific activity in 1942 and 1943, and the main trend of work for 1944 was determined. A number of papers were read by outstanding scientists. Supplementary elections of academicians were held, and those new corresponding members elected at meetings of divisions of the academy were approved. Of the 224 scientists proposed for membership in the academy, 36 will be chosen, and of the 467 candidates for corresponding memberships, 42 places will be filled. This large number of candidates testifies to the increasing growth of Soviet scientific cadres in wartime.

LIMITATION ORDER L–144

THE objects of the amendment to Limitation Order L–144, made on October 9, are to simplify and clarify the provisions of the order and to greatly reduce the number of applications to be filed by users of laboratory equipment. Important features of the amended order are:

(1) Restrictions are entirely eliminated on the delivery of:

(*a*) any item costing $50 or more (unless the item is included in List A of the order);

(*b*) a quantity of the same item costing $50 or more;

(*c*) a miscellaneous order aggregating $200 or more.

(2) No filing of Form WPB–1414 is required for any item costing less than $50.

(3) The filing of Form WPB–1414 under the order is now required only for instruments which are included in List A of the order. Every one, except a distributor, must file for items on List A. No filing is required for items of laboratory equipment not on List A.

(4) List A is reduced by removing several items formerly included and is clarified by using specific names of instruments rather than types, as was done in a few cases on List A of the previous order.

(5) The filing of applications on Form WPB–1414 is not required for accessories and attachments, when purchased separately, even if the instrument with which they are to be used is included in List A.

(6) No application is required for parts or materials to be used for repair and maintenance of existing instruments or for secondhand equipment.

(7) The definition of a distributor is amended to include distributors in the Dominion of Canada. Arrangements have been made with the Department of Munitions and Supply in Canada so that both the distributor and the user of laboratory equipment in Canada will operate in the same way as those in the United States.

(8) When authorization on Form WPB–1414 has been received, certification in accordance with paragraph (d) (2) of L–144 must be sent to the supplier together with authorized preference rating. The authorization copy of Form WPB–1414 should be kept by the applicant and not be sent to the supplier.

(9) Limitation Order L–144, like other limitation orders, does not cover the subject of preference ratings, but the fact should be borne in mind that only the preference ratings assigned by orders listed in Priorities Regulation No. 3, List B Item 21, or a specific preference rating, such as that authorized on PD–1A for a specific item, may be used in the purchase of laboratory equipment as defined in paragraph (a) (1) of amended Order L–144. Blanket MRO Ratings, such as ratings assigned by CMP Regulation No. 5 or 5A, may not be used for the purchase of laboratory equipment.

SAFETY AND TECHNICAL EQUIPMENT DIVISION,
WAR PRODUCTION BOARD,
WASHINGTON 25, D. C.

MELLON INSTITUTE TECHNOCHEMICAL LECTURES, 1943–1944

A SERIES of lectures on the status and outlook of American chemical and related industries, with particular reference to postwar planning, will be presented by specialists of Mellon Institute of Industrial Research during 1943–44. These discourses, which will be delivered on the Thursdays indicated, in the fourth period throughout both semesters, in the auditorium of the institute, will be open to all students in the professional courses in chemical engineering and chemistry in the University of Pittsburgh, as well as to members of the institute:

October 14, Dr. E. R. Weidlein, "Postwar Problems of the Chemical Industries."
" 21, Dr. H. J. Rose, "Trends in Fuel Technology."
November 4, Dr. H. J. Read, "Utilization of Low-Grade Ores."
" 18, Dr. L. A. Carapella, "Light Metals and Alloys."
December 2, Dr. D. F. Helm, "Powder Metallurgy."
" 16, Dr. G. H. Young, "Protective Coatings."
January 6, W. L. Glowacki, "Coal Distillation Products."
" 13, Dr. R. L. Wakeman, "Chemical Derivatives of Hydrocarbons."
February 10, Dr. B. B. Corson, "Catalytic Hydrogenation."
" 17, Dr. L. T. Sanborn, "Utilization of Wood Constituents."
March 2, Dr. J. A. Sauer, "Aviation Constructional Materials."
" 16, Dr. R. J. Sumner, "Cereal Products."
April 6, Dr. G. E. Helz, "Food Dehydration."
" 20, Dr. F. R. Holden, "Control of Industrial Health Hazards."

THE DIRECTOR OF RESEARCH OF THE WELLCOME FOUNDATION

DR. CHARLES H. KELLAWAY, F.R.S., director of the Walter and Eliza Hall Institute of Research in Pathology and Medicine, Melbourne, is reported in the *Australian Journal of Science* to have been appointed director-in-chief of the research activities of the Wellcome Foundation.

Dr. Kellaway has been director of the Walter and Eliza Hall Institute since 1923, and its world-wide reputation is largely the work of his hands. He will take the place of Dr. Wenyon, who was director-in-chief and also acted as director of the Tropical Disease Laboratories of the institution. Under the new arrangements Dr. Kellaway will be director-in-chief and Colonel N. Hamilton Fairley, when he can be released from the army, will direct the Tropical Disease Laboratories. Before the war, the Wellcome Foundation consisted of the Wellcome Research Institution in Euston Road, which housed an excellent historical medical museum and a museum of medical science, and also the Wellcome Bureau of Scientific Research. In addition there were the extensive Physiological Research Laboratories at Beckenham directed by Dr. Trevan, the Chemical Research Laboratories at Snow Hill under the direction of Dr. Henry and an Entomological Research Laboratory at Ripley in Surrey. The foundation had a research organization at Khartoum and a laboratory for the investigation of malaria and black-water fever in Macedonia, which was founded by Dr. Fairley and taken over by the foundation before the war. Members of the board include Sir Henry Dale, president of the Royal Society, and Professor T. R. Elliott, F.R.S.; the chairman is Thomas Bennett.

After the war the Wellcome Foundation plans a vigorous policy of expansion. It is greatly interested in scientific intercommunication within the British Commonwealth of Nations and with the United States, where there is already a research laboratory. An extensive program of research in tropical medicine is proposed, in close cooperation with the London School of Tropical Medicine and the Colonial Office. Chemotherapy will be a major activity of the foundation.

THE AMERICAN-SOVIET SCIENTIFIC CONGRESS

A SCIENTIFIC congress in celebration of the tenth anniversary of American-Soviet diplomatic relations will be held on November 6, 7 and 8 at the Hotel New Yorker and Madison Square Garden under the auspices of the National Council of American-Soviet Friendship.

The scientific meetings will open on Saturday evening, November 6, with a public session on Planning and Post-War Reconstruction in the United States and the U.S.S.R. On Sunday, November 7, panels will be held on Soviet Science and Technology and on Public Health and Wartime Medicine in the U.S.S.R., the latter to be held under the auspices of the American-Soviet Medical Society.

The scientific congress, sponsored by leading scientific men throughout the country, has as its honorary chairmen Professor Walter B. Cannon, of Harvard University; Professor Ernest O. Lawrence, of the University of California, and Professor Gilbert N. Lewis, dean of the department of chemistry of the University of California.

Among those who have accepted invitations to speak are Professor L. C. Dunn, executive officer of the department of zoology of Columbia University, who will make an address before the section of Science and Technology, of which Dr. Harold C. Urey is chairman. The title of Dr. Dunn's address is "Russian Research in the Biological Sciences"; Dr. C.-E. A. Winslow, professor of public health at Yale University, will speak before the medical section on "Public Health in the Soviet Union," and Dr. V. A. Lebedenko, Russian Red Cross representative in the United States, will address the panel on medicine on "Russian Advances in Military Medicine."

CENTENNIAL OF THE OBSERVATORY OF THE UNIVERSITY OF CINCINNATI

THE observatory of the University of Cincinnati will celebrate its centennial on November 5, 6 and 7. The American Astronomical Society will hold its annual meeting in Cincinnati in connection with the centennial. Dr. Harlow Shapley, director of the Harvard Observatory, president of the American Astronomical Society and of the American Association for the Advancement of Science, will be the principal speaker.

The corner-stone of the observatory, the first to be erected in the United States, was laid on November 9, 1843, by John Quincy Adams, sixth president of the United States. The original telescope was for many years the largest in the United States and second in size only to an instrument in the Royal Imperial Observatory at Poulkova, Russia. This 11-inch glass is still in constant service.

Ormsby MacKnight Mitchel, professor of natural philosophy, mathematics and astronomy at Cincinnati College, forerunner of the University of Cincinnati, was the founder of the observatory, virtual builder of its original structure and purchaser of the telescope. Professor Mitchel quarried his own stone, dug his own sand, burned his own lime, dammed a small stream of water, supervised construction of the building and served without pay for two decades. Ground was donated by Nicholas Longworth, grandfather of the late Speaker of the House, Nicholas Longworth, a graduate of the university, on Mount Adams, a Cincinnati hill-top. The observatory was moved in 1873 to its present site on Mount Lookout, several miles farther from the downtown area.

Professor Mitchel was the first director, serving until the Civil War. In 1846 he began the publication of the monthly *Sidereal Messenger*, the first astronomical periodical in the United States. He was succeeded by Professor Cleveland Abbe, who inaugurated a system of telegraphic weather reports which aroused such interest that the U. S. Weather Bureau organized the same service on a nationwide scale.

Dr. Everett I. Yowell, director of the observatory from 1930 to 1940, is now acting in a temporary capacity until a successor to the late Dr. Elliott Smith is appointed. Dr. Smith died on September 29.

SCIENTIFIC NOTES AND NEWS

DR. RICHARD E. SHOPE, a member of the Rockefeller Institute for Medical Research, has been awarded the John Scott Medal, Certificate and Premium of $1,000 for his "discovery of the complex etiology of swine influenza."

AT the annual dinner in Chicago of the American Society for Metals on October 21 the medal of the society was presented to Roy A. Hunt, president of the Aluminum Company of America, Pittsburgh, in recognition of his leadership "in the research and technical development of a metal which has had its entire industrial growth in the past fifty-five years." By consistently sponsoring research and development, Mr. Hunt has helped substantially to advance the arts and sciences relating to metals. The gold medal of the society was presented to Dr. Zay Jeffries, technical director of the lamp department at Cleveland of the General Electric Company, in recognition of his "outstanding metallurgical knowledge and of his great versatility in the application of science to the metal industry."

PROFESSOR ARTHUR H. COMPTON, professor of physics at the University of Chicago, has been presented with the second annual award of the Jewish Education Committee as the "American who has made the most significant contribution to the promotion of human brotherhood." Dr. Compton has been co-chairman of the National Conference of Christians and Jews since 1938.

DR. ARTHUR C. BACHMEYER, director and associate dean of the division of biology of the University of Chicago Clinics, was presented on September 13 during a meeting of the association with the award of the American Hospital Association for meritorious service to the hospital field. According to the inscription on the medal, Dr. Bachmeyer was recognized as "a distinguished administrator and educator whose achievements have greatly advanced standards of treatment for patients and educational opportunities of lasting benefit to his fellow citizens."

DR. FRANK L. CAMPBELL, professor of zoology and entomology at the Ohio State University, was tendered a farewell party by the staff and graduate students of the department on the occasion of his resignation to become director of publications for the American Association for the Advancement of Science. Several gifts were presented to Dr. Campbell, including a bound volume of letters from his former students.

THE Institute of Medicine of Chicago announces that the Jessie Horton Koessler Fellowship for the aid of research in biochemistry, physiology, bacteriology or pathology, which carries a stipend of $500, has been awarded for 1943–44 to Maurice R. Hilleman, who will work with Dr. F. B. Gordon on the immunological relations of the psittacosis-like viruses in the Ricketts Laboratory of the University of Chicago.

DR. C. E. K. MEES, director of research and development of the Eastman Kodak Company, has been appointed Hitchcock lecturer at the University of California. He has chosen as the general subject of his lectures "Science and Evolution." They will be given on October 26 and 28 and on November 2, 4 and 9. The Hitchcock Foundation was established to provide free lectures on scientific and practical subjects, "but not for the advantage of any religious sect or upon any political subject."

OFFICERS elected to direct the American Dairy Science Association for 1944 are Arthur C. Ragsdale, professor of dairy husbandry at the University of Missouri, *Vice-president;* P. H. Tracy, professor of dairy manufactures at the University of Illinois, and C. L. Blackman, professor of dairy husbandry at the Ohio State University, *directors for three-year terms.* A. C. Dahlberg, Cornell University, advances automatically from vice-president to president. Robert B. Stoltz, professor of dairy technology at the Ohio State University, continues as secretary-treasurer, starting his ninth year in that post. Thomas S. Sutton, professor of animal husbandry at the Ohio State University, continues as editor of *The Journal of Dairy Science.* H. F. Davis, of the University of Nebraska, the retiring president, becomes a member of the board of directors. The association will hold a war conference at the Ohio State University on June 21, 22 and 23 in place of the annual meeting.

CAPTAIN C. RAYMOND WELLS, U. S. N., of Jamaica, L. I., chief of the dental division of the National Selective Service System, was installed on October 13 as president of the American Dental Association.

DR. DONALD DUNCAN, of the University of Texas, has been appointed professor of anatomy at the Louisiana State University. Dr. William Lane Williams, instructor in anatomy at the Yale University Medical School, has been appointed assistant professor of anatomy.

FREDERICK GARDNER CLAPP, of Bronxville, N. Y., consulting geologist, who was petroleum adviser to the Imperial Government of Iran in 1927–28 and again in 1933, has arrived in Ankara to become petroleum adviser to the Turkish Government.

R. C. BAINES, of Purdue University, plant pathologist, will conduct an emergency disease survey in

Illinois through an appropriation of special funds made by the U. S. Department of Agriculture. He is giving special attention during late September and October to sweet potato disease problems in southern Illinois, both in the field and in storage.

DR. D. A. SANDERS, veterinarian of the Florida Experiment Station at Gainesville, is now in the Bahama Islands, where he went to investigate diseases among Bahaman livestock and advise animal industry workers there on methods of their control. He was granted a short leave of absence at the request of the Agricultural and Marine Products Board of the Bahaman government.

PROFESSOR EDWARD HINDLE, regius professor of zoology at the University of Glasgow, has been appointed scientific director of the Zoological Society of London.

DR. RUSSELL M. WILDER has resigned as chief of the civilian food requirements branch of the Food Distribution Administration to return to his work at the Mayo Clinic, Rochester, Minn. He will continue to serve as medical adviser to the administration. Norman Leon Gold, Silver Spring, Md., who is assistant to the administrator of agricultural marketing administration, U. S. Department of Agriculture, has been made acting chief.

DR. CORNELIUS P. RHOADS, director of the Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York City, has been granted leave of absence to become chief of the Medical Division of the Chemical Warfare Service of the U. S. Army, with the rank of Colonel.

DR. PAUL M. O'LEARY, deputy price administrator in charge of rationing, on leave of absence as professor of economics at Cornell University, has become head of the Washington staff of the Research Institute of America.

WALTER F. STRAUB, of Chicago, founder and president of the W. F. Straub Company, food products and pharmaceutical manufacturers, has been appointed director of the food-rationing division of the Office of Price Administration. He succeeds Harold B. Rowe, who has been transferred to the Office of Economic Warfare.

ACCORDING to an Associated Press dispatch, William S. Paley, president of the Columbia Broadcasting System, has accepted a special overseas assignment for a limited period from the Office of War Information. Mr. Paley will be associated with C. D. Jackson in the psychological division at General Eisenhower's headquarters.

DR. HAROLD G. WOLFF, associate professor of medicine of the Cornell University Medical College, on October 28 will deliver the first Harvey Society Lecture of the current series at the New York Academy of Medicine. The subject of the lecture will be "Some Observations on Pain."

THE Washington Academy of Sciences celebrated the Copernicus Quadricentennial on October 21 when Stephen P. Mizwa, secretary and executive director of the Kosciuszko Foundation and secretary of the National Copernican Quadricentennial Committee, gave an address entitled "Nicholas Copernicus."

DR. L. H. MACDANIELS, head of the department of horticulture of Cornell University, who was recently appointed administrator of the agricultural extension program of the Near East Foundation, gave on October 20 a lecture on "Horticulture's Present and Future Opportunities and Responsibilities" at the ninth annual meeting of the Long Island Horticultural Society.

DR. A. M. ADAMSON, professor of entomology at the Imperial College of Tropical Agriculture, Trinidad, recently addressed the seminar in zoology of the University of California at Berkeley. In addition to his work in zoology and instructing students in entomology, Professor Adamson is in charge of the plant quarantine station for the British West Indies, British Guiana and British Honduras.

THE fifty-fourth annual meeting of the Association of American Medical Colleges will be held under the presidency of Dr. Waller S. Leathers, dean of the School of Medicine of Vanderbilt University, at the Hotel Statler, Cleveland, from October 25 to 27.

A WINSLOW professorship in one of the sciences at Hamilton College has been made possible by a bequest of $150,000 from the estate of the Reverend Dr. William C. Winslow.

THE *Journal* of the American Medical Association states that the U. S. Public Health Service has made a grant to Washington University School of Medicine, St. Louis, to help to finance a cooperative study of the gross anatomy of the spinal dura mater and the conformation of the posterior surface of the sacrum. The project is under the supervision of Dr. Mildred Trotter and Dr. Virginia S. Lanier, of the department of anatomy, and Dr. Howard E. McKnight, of the department of obstetrics and gynecology. It is anticipated that the results will be a contribution to the procedure of the administration of continuous caudal anesthesia in childbirth.

ACCORDING to the *Journal* of the American Medical Association, the New York Academy of Medicine has announced that the Louis Livingston Seaman Fund of $1,000 is now available. Applications will be received either from institutions or from individuals up to

November 1. The fund will be expended only in grants in aid for investigation or scholarships for research in bacteriology or sanitary science and may be made for securing technical help, aid in publishing original work and the purchase of necessary books or apparatus. Additional information may be obtained from Dr. Wilson G. Smillie, chairman of the fund, 1300 York Avenue, New York City.

Professor Leonard Wing, of the department of zoology of the State College of Washington, Pullman, has received a special grant for the study of the biology of human population. The work will be based on data of 15,000 Quaker families from the monthly meeting records, beginning in 1650. The records have been made available for study by Dr. W. W. Hinshaw, Washington, D. C. The project parallels a study of animal population made by Professor Wing which is now nearing completion.

The daily press reports that Bernard M. Baruch plans to establish an institution for the study and teaching of physiotherapy. He has appointed a committee of specialists, with Dr. Ray Lyman Wilbur, chancellor of Stanford University, as chairman, to survey the field and advise with him on the project. The establishment of a school to select the best from the various phases of physiotherapy was suggested to him by Dr. Walter Belknap Jones, who was for many years an associate on the faculty of the College of Physicians and Surgeons of Columbia University. Serving on the committee with Dr. Wilbur will be Dr. W. T. Sanger, president of the Medical College of Virginia; Lieutenant-Colonel Benjamin A. Strickland, Jr., Army Medical Corps; Dr. Charles F. Behrens, head of the x-ray department at the Naval Medical Center, Bethesda, Md.; Dr. Carl R. Comstock, of Saratoga Springs, N. Y.; Dr. John Coulter, medical director of the School of Physical Therapy, Northwestern University; Dr. Kristin G. Hansson, medical director of the School of Physical Therapy at the Hospital for Special Surgery, New York City, and Dr. Frank Krusen, medical director of the Mayo Clinic and School of Therapy, Rochester, Minn. The committee will have $25,000 at its disposal for this study. Whether the institution to be founded should be an entirely new organization or one established in conjunction with an existing institution is one of the matters to be decided by the group.

The Dominion Government has, according to the Ottawa correspondent of *The Times*, London, approved expenditure for the establishment of plants and equipment in Montreal and Toronto for the production of penicillin. An appropriation has been made to cover the cost of establishing the industry and of the production of the first 26,000,000,000 units of penicillin for use by the Canadian armed forces. This constitutes the largest single order for medical supplies which has so far been placed by the Department of Munitions Supply. According to C. D. Howe, the Minister of Munitions, the new industry will employ 250 men and women, and will come into operation next February; by the middle of April it will be producing a weekly average of 500,000,000 units of penicillin.

The Soviet Academy of Sciences recently sent an expedition headed by Professor Alikhanyan, a Stalin prize winner, to the summit of Mount Ararat to study cosmic rays. The group spent several weeks on Mount Ararat last year and collected valuable data on cosmic rays. These materials were the subject of study during the winter by experts of the Physico-Technical Institute of the Academy of Sciences. It is reported that in the composition of the cosmic rays a considerable quantity of proteins, nuclei of hydrogen atoms, were discovered, the exact nature of which has not yet been investigated. The further examination of this question is one of the most important tasks of the present expedition.

DISCUSSION

ELEMENTS OF THE GENERALITY OF THE GROUP CONCEPT

One of the most instructive brief statements relating to group theory is that the first four fundamental operations of arithmetic, *viz.*, addition, subtraction, multiplication and division, are combined into one operation in group theory. This one was at first usually called multiplication, but in the recent literature it is also frequently called addition. It represents the combination of the elements of a group in pairs so as to obtain a single element of the group for each such pair and it is commonly denoted by the same symbol as is used for the corresponding operation in arithmetic. The possibility of combining the said four fundamental operations of arithmetic into one in group theory suggests that the concept of group is more general than the concept of number, notwithstanding the fundamental importance of number in the development of mathematics throughout the entire period of this development up to the present time.

The fact that the group concept is more general than the number concept is also suggested by the use of numbers for the elements of a group in special categories of groups. Moreover, the definitions of abstract groups have always been so formulated that our ordinary numbers are included among the possible elements which may be involved in these groups. In particular, these numbers obey the associative law when they are combined either by addition or by multiplication, and this law has usually been assumed either explicitly or implicitly in the definitions of an abstract group. It is a fundamental fact in the history of mathematics that this law did not receive a special name in the mathematical literature until about the middle of the nineteenth century when it was thus named by the Irish mathematician, W. R. Hamilton (1805–1865), the first two volumes of whose "Mathematical Papers" were published by the Royal Irish Academy in 1931 and 1940, respectively.

Since substraction is the inverse of addition and division is the inverse of multiplication two of the said four fundamental operations of arithmetic disappear if an operation and its inverse are regarded as belonging to the same more general operation and these four operations thus become only two fundamental operations of arithmetic. The fact that the subtraction of a positive number is equivalent to the addition of the corresponding negative number was noted in the *Arithmetica integra* by M. Stifel (1544), who used these numbers just as we do now, without, however, giving a satisfactory theory for this use. On the other hand, the ancient Babylonians already regarded the division by positive integers as the multiplication of the dividend by the inverse of the divisor and constructed extensive tables of the inverses of integers. Nothwithstanding the fact that the use of negative numbers and common fractions theoretically reduced the said four fundamental operations to two such operations, mathematicians usually continued to speak of them as four operations even in algebra where the use of negative quantities is commonly considered from the beginning of the subject in our schools.

It has frequently been emphasized that in group theory the elements are usually undefined and only the laws of the combinations of these elements are considered, but it is not so commonly noted that in arithmetic the numbers employed are also usually undefined. Efforts to define the term number have been made in many instances, but it is questionable whether any of them have been actually successful. Such statements as that number is the property of a set of individuals which is independent of the nature of these individuals and is common to all sets of individuals which can be placed in a (| , |) correspondence are in reality not a definition of the term positive integer, but merely a statement of some of the assumed properties of such integers. It is, however, true that for thousands of years it has been found convenient to combine positive integers in pairs so as to obtain other such integers, according to two fundamental laws of combination called addition and multiplication while the elements of a group are combined according to only one such law. This is further evidence of the fact that the group concept is more general than the number concept.

This greater generality of the group concept, while the number concept has been the more important of the two in the development of mathematics, emphasizes the need of distinguishing between generality and importance in mathematical theories. It also tends to explain why the group concept received growing attention in the latter half of the nineteenth century and the early part of the present century, for it was then when generality received growing attention on the part of mathematicians. It is only natural that there are occasional reactions with respect to recent increased emphasis and some of the current mathematical writings exhibit evidences of such reactions,[1] but growing generality can be observed throughout the entire history of mathematical developments, and these temporary reactions should not seriously disturb the modern students of our subject, who realize that it is not free from changing fashions even if it has always made a relatively strong appeal to the male members of society.

G. A. MILLER

UNIVERSITY OF ILLINOIS

PROTEIN CONCENTRATES FROM GRASSES

THERE is at present a marked shortage of concentrates high in protein value available for consumption by farm animals. One of the most abundant sources of protein is grass, only part of which is used for pasture, hay or silage. If the remainder could be converted economically into a concentrated non-perishable form of protein it might be valuable in relieving the present shortage of protein concentrates.

Methods of extracting protein from biological substances may be found in the literature, but to the author's knowledge none has been made use of in preparing proteins from forage crops on a large scale. The author has made a number of preparations on a laboratory scale and the details will be published elsewhere. An example is given here.

Dried ground grass was extracted overnight at room temperature with 0.25 normal sodium hydroxide and then filtered through cheesecloth. The filtrate was brought to pH 3.6 with hydrochloric acid and a precipitate was filtered off, dried and ground. The precipitate, dark green in color and with a grassy flavor, contained 58 per cent. protein on the dry basis, 6 per cent. ash and less than 1 per cent. of lignin and cellulose. It also contained 440 p.p.m. of crude carotene, but this amount decreased during laboratory storage. Based on a ton of dry grass the yield of this substance was about 285 pounds. The grass residue, yielding about 875 pounds per ton and still containing 44 per cent. of the original protein, appeared to be a fair quality stock feed.

---

[1] For instance, on page 168 of "What is Mathematics?" by Richard Courant and Herbert Robbins (1941), it is asserted that "in geometry, perhaps, the importance of the group concept has been a little exaggerated."

Extraction of the protein concentrate with 95 per cent. alcohol removed about 20 per cent. of its dry weight but only 4 per cent. of its total nitrogen. This final product was dark in color and tasteless and contained over 72 per cent. protein on the dry basis. Its calculated yield per ton was 220 pounds.

It is suggested that either the crude or the extracted product could be made from surplus forage, or forage otherwise wasted, and if economically produced should be useful in supplementing present stocks of protein concentrates, particularly for poultry and hog rations.

J. T. Sullivan

U. S. Regional Pasture
Research Laboratory,
State College, Pa.

WHY THE KILGORE BILL?

There are probably few leading men in science who would not, with minor qualifications, agree with the five major objectives set forth by Senator Kilgore in his article in Science of August 13, discussing "The Science Mobilization Bill." These may be abbreviated to read as follows:

(1) The need for a central independent agency of the Government devoted exclusively to the progress of expansion in Science and Technology.

(2) The need for integration of existing Government research and development facilities.

(3) The need for active Governmental support of fundamental research.

(4) The need for a uniform and effective policy to achieve the fullest utilization of scientific and technical manpower in wartime.

(5) The need to promote the use of Government patents in the interest of the public.

It is probably on the basis of such desirable objectives that Senator Kilgore, in his introductory paragraphs, ventures the rather broad statement "that the men of science favor the bill" (S. 702). From the discussions and comments that have come to my attention since the publication of my contribution to this discussion in Science of June 4, a large majority of the leading scientific men consulted have expressed strong opposition to the passing of S. 702. Unfortunately, a few have expressed violent opposition with words not always scientifically chosen. Unquestionably, however, all these men would find no contention over the objectives to be gained in the abbreviated statements quoted above. It is increasingly clear that a desirable objective is one thing and the method of obtaining such an objective is quite a different thing. It is not primarily a question of whether the ends justify the means but rather a question of whether the ends could be attained by the means proposed. This appears to be the basis and the only basis for a sound and intelligent discussion of the Mobilization of Science Bill.

No scientist can but be gratified as to the Senator's statement, "I have long realized the basic importance to the welfare of the country of a free science and an expanding technology." Perhaps Senator Kilgore over-compliments the scientist when he states that "Scientific and technical men hold in their heads and hands the collective knowledge of the ages." The free and copious publication in technical literature of the results of basic research in every conceivable branch of science shows the eagerness on the part of a scientific worker to give to the public the benefit of his findings and thus would appear to provide an adequate answer to the Senator's question, "Whose knowledge is it?"

It becomes obvious from a careful study of the Bill S. 702 that the proposed legislation would attempt to make impossible the repetition of certain unfortunate uses of technical knowledge by "vested" and "selfish interests." Such a problem is not specifically a problem of science and technology but a problem of society. As long as human nature is what it is, the scientific approach must take into consideration "selfish interests" as a specific entity in human behavior inherited through evolutionary processes as a means for the preservation of the individual and the species. The study of "selfish interests" presents a problem in social welfare that should be approached with the same order of scientific intelligence as one approaches the problems of instability in gravimetry or geomagnetism. Such can not be dismissed by legislation, nor does it appear certain that its dismissal would bring about an unmitigated Utopia in science.

No one proposes that rugged individualism should be fostered at the expense of public welfare. "Selfish interests" gaining the seat of authority have brought ruin to the Axis countries. It is, I think, the danger of the creating of an opportunity for "selfish interests" in high places that has caused the apprehension among those scientists who have expressed opposition to the Kilgore Bill. When we are willing to recognize that "selfish interests," however undesirable, is a potential entity that must be considered and accepted as a scientific fact, the question raised by the Mobilization of Science Bill resolves itself into the relative dangers of distributed control as against centralized control, of cooperative arrangements against an attempted compulsion. It is because of the unlimited powers of the centralized control proposed in the Kilgore Bill, irrespective of the details of its sections, that so clearly defines the issue.

Reviewing the five objectives of the Senator's article in SCIENCE, there appears to be no valid reason why an already existing independent scientific agency of the Government, namely, the National Research Council, can not or could not bring about the objectives for which the Kilgore Bill was proposed. The Executive Order of President Wilson creating the National Research Council on May 11, 1918, so specifically directs. At the risk of repetition, and for the purposes of comparison with Senator Kilgore's five objectives, we quote:

> The duties of which [the National Research Council] shall be as follows:
>
> (1) In general, to stimulate research in the mathematical, physical and biological sciences, and in the application of these sciences to engineering, agriculture, medicine and other useful arts, with the object of increasing knowledge, of strengthening the national defense, and of contributing in other ways to the public welfare.
>
> (2) To survey the larger possibilities of science, to formulate comprehensive projects of research and to develop effective means of utilizing the scientific and technical resources of the country for dealing with these projects.
>
> (3) To promote cooperation in research, at home and abroad, in order to secure concentration of effort, minimize duplication and stimulate progress; but in all cooperative undertakings to give encouragement to individual initiative, as fundamentally important to the advancement of science.
>
> (4) To serve as a means of bringing American and foreign investigators into active cooperation with the scientific and technical services of the War and Navy Departments and with those of the civil branches of the Government.
>
> (5) To direct the attention of scientific and technical investigators to the present importance of military and industrial problems in connection with the war, and to aid in the solution of these problems by organizing specific researches.
>
> (6) To gather and collate scientific and technical information, at home and abroad, in cooperation with governmental and other agencies, and to render such information available to duly accredited persons.

One can not review the history of the establishment of the National Research Council and escape the conclusion that the intent of such an agency was to accomplish the very purposes for which presumably the Kilgore Bill originated, but purposely avoiding the objectionable defects which are so flagrant to those who have opposed the proposed legislation in S. 702.

Until, therefore, the National Research Council is proved to be ineffective and void of any means of making itself so, the wisdom for further congressional acts for such a purpose will remain open to question. Were the Kilgore Bill to be passed as is, the only amendment that would appear to be consistent with such action would seem to require that with the passage of this act the National Research Council and possibly even the National Academy of Sciences should thereupon become dissolved. In times of such national emergency as confronted President Wilson and President Lincoln, one has difficulty in believing that it was the intent that these institutions were to be perpetuated primarily for honoring distinguished scholars with membership, however creditably such honor could be bestowed. In conclusion, why the Kilgore Bill?

HARLAN T. STETSON

NEEDHAM, MASS.

SCIENTIFIC BOOKS

CYTOLOGY

Fundamentals of Cytology. By LESTER W. SHARP. 267 pages. 6 × 9. 176 illustrations. New York: McGraw-Hill Book Company, Inc. $3.00.

PROFESSOR SHARP, whose "Introduction to Cytology" received a deservedly warm welcome (there were three editions between 1921 and 1935), has in the present book essayed to bring the subject to the level of the college student who has only an elementary course in botany and zoology as a background. Sharp is exceptionally skilful in presenting and clarifying complex issues and if any one is equal to the task, it is he. That he has not been completely successful in his attempt is due to the fact that in the present state of confusion and clash of opinions some aspects of cytology can not possibly be given a portrayal that is both elementary and fair. The book comprises six chapters devoted to more general aspects and to the extranuclear elements of the cell, and eleven on the cytology of reproduction and genetics. This is a distribution that well reflects the status of our information concerning the cytoplasm and cytogenetics, respectively, especially if cellular physiology be not stressed.

In the chapters on the cytoplasmic components of the cell there is a great volume of information and, indeed, the treatment is often more like a condensation than a simplification. The instances where Sharp has attempted the latter, as in the case of chondriosomes and Golgi material, are not always entirely successful, but in the present state of confusion of those particular subjects that is hardly to be wondered at.

The difficulty is at least as great in dealing with cytology in its bearing on genetics. In some aspects, as in the chromosomal variations of structure and number and of hybridity, the book is concerned with aspects which for the present are generally accepted. In presenting them to the student, Sharp is at his best. But in the basic mechanisms that underlie chromosomal behavior, the difficulties of elementary presentation become almost insurmountable. To be sure, by soft-pedaling and ignoring the dubious parts of the evidence, these sections could be written so as to give a logical and well-rounded account. Many geneticists conceive of the cytological background in this way, and several books on genetics and cytology have so treated it. Generally, Sharp, too, sketches his preliminary outlines in this fashion, but he is too good a cytologist to let his case rest on such a treatment and thus often follows it up with the doubts and faults that lurk behind the beautiful story. The chapter on chromosomes is an illustration of this and though to a working cytologist it seems like an excellent, brief survey, one wonders what an elementary student's attitude may be about the number of chromonemata, coiling, heteropycnosis and salivary chromosomes, when he gets through with it. It is for this reason that it is to be regretted that Sharp did not expand the conclusions which terminate about half of the chapters, for it is there that his skill in outlining basic concepts is especially evident.

The criticism sometimes made of Sharp's earlier book that zoological cytology does not meet with as adequate consideration as botanical cytology, will likely be made here also. In a way, the illustrations reflect this unequal distribution, for there are 115 figures of botanical against 54 figures of purely zoological subjects. But aside from the fact that Sharp is himself primarily a botanist and quite naturally more at home in his side of the field, it might be pointed out that especially in the cytogenetics of the last ten years the animal cytologist has definitely fallen behind his botanical colleague in furnishing the evidence that is advancing our knowledge. However, this does not altogether explain the somewhat uneven judgment employed in listing reference works to animal cytology. Thus the chapter on animal reproduction, perhaps the weakest in the book, is supported by twelve references. Of these, six are on protozoa, and though this group has admittedly been somewhat neglected by both zoologists and botanists, that seems a little disproportionate. Of the remaining six references, Hegner's 1914 book certainly does not meet the demands of 1943, and Agar's and Doncaster's treatises, both published twenty-three years ago, can hardly be expected to give an adequate survey of the modern status of the subject.

As already indicated, many aspects of cytology are at present in that state of flux which betokens progress. This renders it almost impossible to reduce it to simple outlines and by the same token makes it very difficult to present it justly to a student with only an elementary background. If the attempt is nevertheless to be made, Sharp's book will prove of great help.

Franz Schrader

Columbia University

QUANTITATIVE ANALYSIS

Elementary Quantitative Analysis. By Carl J. Engelder. Third edition. viii + 283 pp. 15 × 23 cm. New York: John Wiley and Sons, Inc. 1943. $2.75.

This book is designed for a short course in quantitative analysis. It is divided into four sections: "Fundamental Principles of Quantitative Analysis"; "Volumetric Analysis"; "Gravimetric Analysis"; and "Systematic Quantitative Analysis."

The section on fundamental principles introduces the student to the subject and includes discussions of the scope and theoretical basis of quantitative analysis, preparation of sample, mathematical operations, errors and precision, reagents and the analytical balance. This entire series of discussions occupies less than twenty-six pages.

The section on volumetric analysis includes a chapter on theory, apparatus, technique and calculations, and chapters on neutralization methods, redox methods and volumetric precipitation methods. Both the normality and the titer methods of expressing solution strength are discussed with emphasis on the latter method. The chapter on neutralization methods includes the preparation of standard acid and alkali, using sodium carbonate as the primary standard; the determination of sodium carbonate in soda ash, the strength of potassium acid phthalate solution and the strength of oxalic acid solution; and the theory of hydrolysis, indicators and differential titrations. No mention is made of the removal of carbonate from standard alkali. The redox chapter includes experiments with permanganate, iodine, dichromate and ceric sulfate. The precipitation methods include the determination of chloride, silver thiocyanate and cyanide. Throughout the section, the author encourages the use of two burettes with a resultant jockeying back and forth in finding end points.

The section on gravimetric analysis gives procedures for chloride, iron, sulfate, calcium, magnesium and phosphate. The theory of gravimetric precipitation and purification of precipitates is almost totally neglected.

The section on systematic analysis includes general information which should be useful for reference purposes.

There are a number of aids for the student and the instructor: question and problem sets following each chapter; a plan of the course; and an appendix containing sample report forms, a division on the literature of analytical chemistry, a division on reagents and supplies, density tables, gravimetric factors and a table of five-place logarithms.

The experiments are well chosen and conveniently arranged, if a bit old-fashioned, but the book suffers from an attempt to cover too much ground in too short a space with a resultant dearth of specific information. However, the material included could serve as good basis for a course in quantitative analysis if properly expanded in the accompanying lectures.

Frederick R. Duke

Princeton University

THE CHEMICAL FORMULARY

The Chemical Formulary. Vol. VI. By H. Bennett, editor-in-chief. xx + 636 pp. Brooklyn, N. Y.: Chemical Publishing Company, Inc. 1943. $6.00.

This is the sixth volume of the series, and as in previous volumes the editor-in-chief has had the assistance of an editorial board of about fifty specialists in industrial and educational organizations. A footnote to the preface states that all the formulae in volumes I to VI are different except for a few typical cases used in the introduction to illustrate directions and advice for new users of the volumes.

The fields covered in the present volume include Adhesives, Beverages, Emulsions, Inks, Paints and Varnishes, Paper, Pyrotechnics and Explosives, Rubber, Plastics, Detergents, Textiles, etc. A timely section is included on special formulae of military interest.

Another section which may be of value to many users is devoted to substitutes for scarce or priority materials. A perusal of this section would seem to indicate that many of the suggested substitutes would be far from universally adaptable but might be useful for certain specific applications.

A directory of sources of chemicals and supplies is included. This will prove of value to users of the volume, since many of the substances mentioned in formulae throughout the book are trade-marked or copyrighted "trade names" and could not be secured on the open market either by reason of their compound nature or secret composition. The editor feels justified in including such substances, since without them many ideas and processes offered in formulae of specialty producers would have been automatically eliminated.

Tables of weights and measures, a list of foreign sources of chemicals and an index of some 2,400 entries complete the present volume. Previous volumes have been widely reviewed in technical and trade publications such as *American Dyestuffs Reporter, Electrochemical Society Bulletin, Modern Plastics, Rubber Age,* etc., and have received most generous and favorable comment. The present volume is a worthy addition to the series and will doubtless find wide acceptance among chemists and technologists throughout the industry.

W. D. Turner

Columbia University

SPECIAL ARTICLES

INFLUENCE OF ADRENAL CORTICAL SECRETION ON BLOOD ELEMENTS[1]

The marked decrease of lymphoid tissue produced by augmented adrenal cortical secretion[2] has led to an examination of the changes in blood elements resulting from adrenal cortical stimulation. The availability of purified pituitary adrenotropic hormone,[3] the normal physiological regulator of adrenal cortical activity, makes possible the study of fundamental phenomena resulting from adrenal cortical secretion. The establishment of these data should be of significance in the elucidation of changes following stimulation of the adrenal cortex by a variety of agents.

It is the purpose of this communication to indicate the striking alterations in blood elements which result in normal, approximately fifty-day old, mice of both sexes (CBA strain, Strong) within a few hours following a single subcutaneous injection of pituitary adrenotropic hormone (1.0 mg in 0.5 ml solution). Blood analyses have been conducted at intervals after hormone injection, using groups of mice at each time interval, rather than successive determinations on the same animals. The blood picture observed is characterized by the following: (a) decrease in total leucocyte count, (b) decrease in absolute number of lymphocytes, and (c) increase in absolute number of polymorphonuclear cells. These alterations in the leucocyte elements are evident three hours following hormone injection, and the maximum effect, which is characterized by an extreme lymphopenia, is observed at nine hours after injection. Shortly thereafter the leucocyte picture tends to return to normal. These changes are depicted in Fig. 1.

---

[1] This investigation has been aided by grants from the International Cancer Research Foundation, the Fluid Research Fund, Yale University School of Medicine and the Committee on Therapeutic Research, Council on Pharmacy and Chemistry, American Medical Association.

[2] T. F. Dougherty and A. White, *Proc. Soc. Exp. Biol. Med.,* 53: 132, 1943.

[3] G. Sayers, A. White and C. N. H. Long, *Proc. Soc. Exp. Biol. Med.,* 52: 199, 1943.

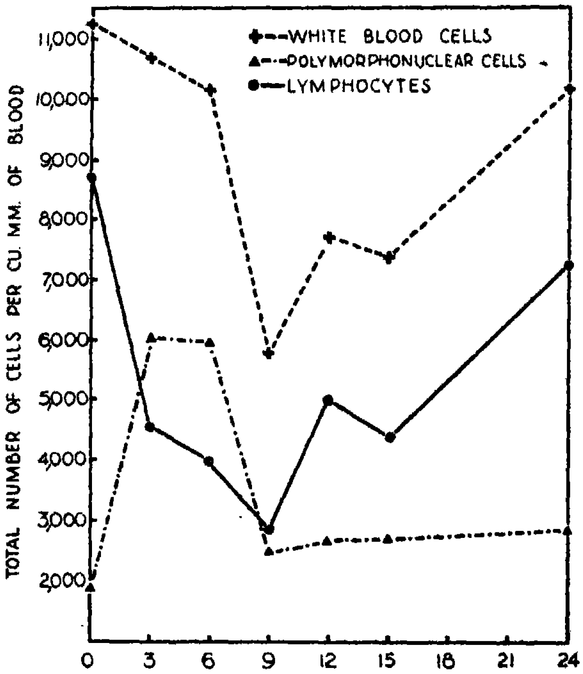


FIG. 1. Alterations produced in the total leucocyte, lymphocyte and polymorphonuclear blood counts of normal mice receiving, at zero time, a single, subcutaneous injection of 1.0 mg of pituitary adrenotropic hormone. The points on each curve at 3, 6, 9, 12, 15 and 24 hours after hormone injection are, respectively, the averages of data for groups of 5, 5, 7, 6, 7 and 5 animals. A total of 35 animals were employed.

An initial increase in hemoglobin and red blood cell count was generally observed within three to six hours after a single injection of adrenotropic hormone. This effect, however, did not persist in other animals injected daily with the hormone. The increase in hemoglobin concentration was not due to hemoconcentration.

In order to determine whether the change in leucocyte picture might be due to a non-specific protein effect, mice of the same age and strain were injected with 2 mg of prolactin[4] and blood determinations made on animals sacrificed at 3-, 6- and 9-hour intervals following the hormone administration. Other mice received subcutaneously 2 mg of serum gamma globulin (human) or one unit of posterior pituitary pressor principle (Parke-Davis). Injection of prolactin or pitressin produced an initial increase of polymorphonuclears, but no significant decrease in total leucocytes or lymphocytes. In contrast to the adrenotropic hormone injected animals which showed the maximum alteration in blood picture (lymphopenia) nine hours after hormone injection, mice given prolactin or pitressin had a normal leucocyte count at this time. Serum globulin injection produced no alteration in blood leucocytes. This would suggest that the results with prolactin are not attributable to a non-specific protein effect, but are likely the result of contamination of the prolactin preparation with posterior lobe principle.[5] The latter may initially stimulate the adrenal cortex.

Evidence that the effect of adrenotropic hormone on the leucocyte picture is mediated through the adrenal cortex is seen from the following summary of other experimental results which have been obtained:

(1) The injection of adrenotropic hormone, prolactin or pitressin into adrenalectomized mice does not produce a decrease in total leucocyte or lymphocyte counts.

(2) The injection of 0.5 ml of adrenal cortical extract (Wilson) in normal and in adrenalectomized mice produces a fall in total leucocytes, an absolute lymphopenia and an absolute polymorphonuclear leucocytosis. The blood changes produced by adrenal cortical extract administration in both normal and adrenalectomized mice are identical in degree with those occurring after adrenotropic hormone injection (Fig. 1). However, the time relationships are somewhat different in that the maximum leucocyte changes in mice given cortical extract occur at an earlier time.

Changes in the blood elements, identical with those presented in Fig. 1, have been observed in 250 to 300 gram male rats (Sprague-Dawley strain) given single injections of either 5 mg of adrenotropic hormone or 5 ml of adrenal cortical extract (Upjohn).[6]

A group of 25 mice were given daily injections of 1 mg of adrenotropic hormone for 15 days and blood determinations made on groups of 5 animals at 3-day intervals. Throughout the entire injection period, the animals did not show consistent changes in total leucocyte count, but exhibited an absolute lymphopenia and an absolute polymorphonuclear leucocytosis. Similar groups of mice injected chronically with 2 mg of prolactin each day showed a normal blood picture throughout the experimental period.

---

[4] A. White, R. W. Bonsnes and C. N. H. Long, *Jour. Biol. Chem.*, 143: 447, 1942.

[5] Assay of the prolactin preparation used showed it to have a pressor activity (cat) equivalent to 0.6 unit pitressin (Parke-Davis) per mg.

[6] The experiments in rats have been conducted in collaboration with Mr. C. U. Lowe.

The day-to-day constancy of the increase in polymorphonuclear leucocytes and the decrease in lymphocytes in animals injected daily with adrenotropic hormore and the lack of any leucocyte changes in prolactin treated animals emphasize the significance of the adrenal cortex in the phenomena which are being reported.

The changes which have been observed in the leucocyte picture following adrenotropic hormone injection are essentially those which have been described for a variety of circumstances, some of which may now be directly attributed to adrenal cortical stimulation. For example, inanition stimulates adrenal cortical activity and produces a similar leucocyte picture.[7] It is not unlikely that other agents and experimental procedures which affect the adrenal cortex, and lymphoid tissue, are accompanied by these leucocyte changes. These possibilities are being subjected to experimental study.

The experiments summarized here will be published in detail elsewhere.

THOMAS F. DOUGHERTY[8]
ABRAHAM WHITE
DEPARTMENTS OF ANATOMY AND PHYSIOLOGICAL
CHEMISTRY, SCHOOL OF MEDICINE,
YALE UNIVERSITY

THE NATURAL OCCURRENCE OF RIBOFLAVIN DEFICIENCY IN THE EYES OF DOGS[1]

OBSERVATION of malnourished persons for thirteen years has convinced me that the natural development of dietary deficiency diseases is slow; the onset insidious and difficult to recognize. Long before the nutritive failure can be diagnosed as pellagra, beriberi, scurvy, riboflavin deficiency or some one clear-cut syndrome, the afflicted persons have had months or years of ill health. Often they are unbelievably weak, listless and able to do little if any work. In the carefully selected case, the rapid improvement following intensive and persistent nutritive therapy leaves no doubt that the tissues function at a higher level soon after the missing substances are provided in sufficient amounts. Although the whole matter is very complex, comprehensive study over a period of several years has given us some valuable information. Since members of a family living together tend to eat a similar diet, we have adopted the policy of studying the entire family. That is to say, whenever a diagnosis of deficiency disease is made, we extend our studies to include the family. All members of the family are asked to report to the clinic for observation. Dietary surveys on the patient and on each member of his family are made by frequently visiting the homes. During such visits, we have observed that the family pets often appear emaciated and weak. Realizing that these animals usually subsist on scraps from the family table, it was natural for us to think that they, too, might have nutritional deficiencies. Examination of the dogs showed that black-tongue was not uncommon. (This spontaneous canine black-tongue responds as quickly to nicotinic acid as does pellagra in human beings.) Still more recently we have observed eye symptoms in dogs which appear similar to the ocular lesions of riboflavin deficiency in persons. These lesions respond as dramatically to riboflavin therapy as do those in human beings.

This communication is concerned primarily with such lesions in the eyes of four dogs belonging to families on which we were making laboratory and clinical studies. As these findings give an idea of the far-reaching effect of inadequate nutrition they seem worthy of separate publication at this time.

The dogs were emaciated, weak, sluggish, apathetic and held their heads much lower than the rest of their bodies. They refused food and all efforts to coax them to eat were without avail. Each dog had diarrhea characterized by frequently watery, foul-smelling stools. Saliva drooled continuously from their mouths. Examination of the mouth revealed the oral mucous membrane lesions characteristic of black-tongue.[2] While examining these animals lacrimation was observed. Even the light from a small flashlight in their eyes enlisted photophobia. In general the eyes appeared similar to those of persons with riboflavin deficiency which I have described,[3,4] and this suggested to me that these dogs had not only black-tongue, but riboflavin deficiency as well. A careful examination of their eyes showed pronounced injection of the sclerae and conjunctiva of both eyes. The vessels were unusually dilated and tortuous. There was a suggestion of rotary nystagmus. The animals did not keep their eyes still enough to carry out satisfactory slit lamp examinations. However, clinically the process appears similar to that in human beings, although in each of these dogs it was more extensive than I usually have seen in persons.

---

[7] C. F. Shukers and P. L. Day, *Jour. Nutrition*, 25: 511, 1943.

[8] Fellow of the International Cancer Research Foundation.

[1] University of Cincinnati Studies in Nutrition at the Hillman Hospital, Birmingham, Alabama. From the Department of Internal Medicine, University of Cincinnati. The expenses of this study were defrayed by funds given by the Nutrition Foundation for the study of earlier methods of diagnosing deficiency states and by the Abbott Laboratories.

[2] Garfield G. Duncan, "Diseases of Metabolism," 489 pp. Philadelphia: W. B. Saunders Company. 1942.

[3] Tom D. Spies, William B. Bean and William F. Ashe, *Annals of Int. Med.*, 12: 1830–1844, May, 1939.

[4] H. D. Kruse, V. P. Sydenstricker, W. H. Sebrell and H. M. Cleckley, *Public Health Reports*, 55: 157–169, January 26, 1940.

The photophobia was so severe and it was so difficult to keep the eyes still that satisfactory colored photographs were obtained only after numerous trials and errors.

A brief case report follows:

It is common knowledge that dogs with severe black-tongue are likely to die suddenly and since we have been able to relieve animals with spontaneous black-tongue,[2] we injected 150 mgs of nicotinic amide as soon as the dog had been carefully examined and illustrations made. Twenty hours later the dog showed remarkable improvement. He was obviously much stronger and ate the food offered. The fiery redness of the oral mucous membranes had faded considerably. Salivation had decreased and the diarrhea had stopped. The appearance of the eyes, however, remained unchanged. Next, 50 mgs riboflavin[5] were injected intravenously. Twenty-four hours later there was less lacrimation and photophobia. The injection had receded and there were fewer dilated and tortuous vessels in the conjunctiva and sclerae. Nystagmus was not present. Seventy-two hours later there was no detectable lacrimation or photophobia, and the redness and general increase in vascularity had subsided. Indeed, only very careful examination revealed "ghost vessels"—vessels which had been engorged but were now only faintly discernible.

Summary

In four dogs, the diarrhea, increased salivation and mucous membrane lesions characteristic of black-tongue were relieved within 24 hours following the administration of 150 mgs nicotinic amide, whereas the lacrimation, photophobia and extreme injection of the eye vessels did not diminish. These severe eye lesions regressed greatly 24 hours after the injection of 50 mgs of riboflavin, and in 72 hours had disappeared.

The simultaneous occurrence of nicotinic acid and riboflavin deficiency in four dogs is evidence that such deficiencies occur as mixed diseases rather than as single entities.

These findings are further evidence of the universality of nutritional deficiencies, since they suggest that deficiency diseases among the pets of families with deficiency diseases are not uncommon. In at least one instance the finding of nutritional deficiencies in a dog eating scraps from the family table led to a better understanding of the ill health of the family, none of whom had diagnostic lesions of deficiency disease at the time, although they all complained of weakness, nervousness, irritability and loss of appetite—the vague and ill-defined symptoms characteristic of deficiency diseases in the early stages.

Tom D. Spies

---

[5] A special concentrated product sent to me for experimental trial by Hoffmann-La Roche, Inc.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

IDENTITY OF A LETHAL AGENT IN BROTH FILTRATES OF HEMOLYTIC STREPTOCOCCI WITH ERYTHROGENIC TOXIN[1]

The similarity of a recently described lethal agent produced in broth cultures by hemolytic streptococci (Lancefield Group A)[2] to erythrogenic toxin raises the question of their differentiation.

Marked differences in heat stability indicate the existence of at least two kinds of hemolytic streptococcus toxin: the heat stabile erythrogenic and the heat labile hemolytic toxins. The resistance of cyrthrogenic toxin to comparatively high temperatures for considerable periods of time is well established.[3, 4] Since the lethal agent described, which was resistant to temperatures which do not completely inactivate erythrogenic toxin, and was lethal for mice, the effect of intravenous injection of heated and unheated erythrogenic toxin in mice was studied.

The toxins used were unpurified filtrates. Skin test doses per milliliter were determined by toxin-antitoxin flocculation. Table 1 summarizes the results obtained in mice by the intravenous injection of unheated toxins. Table 2 summarizes the results obtained with heated toxins and toxin-antitoxin mixtures. Toxin-antitoxin neutralization with heated and unheated toxins was checked by the intracutaneous rabbit test described by Fraser and Plummer.[5]

TABLE 1

Determination of M. L. D. of Erythrogenic Toxin: Intravenous Injection in Mice

Toxin	Dose (ml)	Skin test doses × 100	Result
Streptococcus NY 5 (Type 10)	1.0	300	+
	0.5	150	+
	0.25	75	–
Streptococcus BFO (Type 2)	1.0	300	+
	0.5	150	+
	0.25	75	–

(+) = death within 10 min.
(–) = no reaction.

Undiluted toxin contained approximately 2,000,000 skin test doses per ml. Toxins diluted 1:66 contain approximately 30,000 skin test doses per ml.

Mice 20–25 g in weight used.

---

[1] From the Department of Preventive Medicine, Harvard Medical School and House of the Good Samaritan, Boston, Mass.

[2] T. N. Harris, *Jour. Bact.*, 43: 739, 1942.

[3] H. J. Parish and C. C. Okell, *Jour. Path. and Bact.*, 33: 527, 1930.

[4] G. A. H. Buttle and A. S. R. Lowdon, *Jour. Path. and Bact.*, 41: 107, 1935.

[5] F. H. Fraser and H. Plummer, *Brit. Jour. Exp. Path.*, 11: 291, 1930.

Inspection of the tables shows that the intravenous administration of 15,000 S.T.D. produces a rapidly fatal result in mice. Temperatures as high as 100° C. for short periods of time do not completely inactivate erythrogenic toxin as evidenced by the fatal result following intravenous administration of larger doses of such heated filtrates (Table 2).

Thus, the characteristics described for the agent in broth filtrates of hemolytic streptococci are not distinguishable from those of erythrogenic toxin with respect to heat stability and lethal action in mice. Furthermore, neutralization by erythrogenic anti-toxin completely obliterates the lethal action of broth filtrates of hemolytic streptococci in mice. For these reasons, unless it is shown that the lethal agent described remains in broth cultures after absorption of erythrogenic toxin with antitoxin, it can not be considered as distinct from erythrogenic toxin. Erythrogenic toxin probably is not the only factor involved in the toxic manifestations of hemolytic streptococcus infection in man. This seems quite evident from the observations of Kenny and Colebrook[6] on puerperal sepsis. There is some evidence that certain hemolytic streptococci produce a toxic substance when grown in tissue media.[7] However, due to the diverse biological phenomena presented by the erythrogenic toxin, its presence as a "contaminating factor" must be considered in interpreting the results obtained in animals with any filtrate of the hemolytic streptococcus.

TABLE 2

HEAT STABILITY OF ERYTHROGENIC TOXIN: INTRAVENOUS INJECTION OF TOXIN AND TOXIN-ANTITOXIN IN MICE

Toxin*		Dose (ml)	Result	Toxin neutralized by NY 5 antitoxin†
Streptococcus NY 5 (Type 10) and Streptococcus BFO (Type 2)	Unheated	1.0	+	–
	Heated 56° C.– 30 min	1.0	+	–
	" 80° – 30 "	1.0	+	–
	" 100° – 20 "	1.0	–	–
	" 100° – 20 "	2.0	+	–
	" 100° – 60 "	1.0	–	not done
	" 100° – 60 "	2.0	–	" "
	" 100° –120 "	1.0	–	" "
	" 100° –120 "	2.0	–	" "
Broth controls	Unheated	2.0	–	" "
	Heated 100° C.–120 min	2.0	–	" "

(+) = death within 10 min.
(–) = no reaction.
* Contained approximately 2,000,000 skin test doses per ml. Diluted 1:66 to contain approximately 30,000 skin test doses per ml. 1.0 ml. contained 2 M.L.D. (mouse, Table 1).
† Toxins neutralized by equivalent units of antitoxin.

GEORGE E. FOLEY

DEANTIGENATED BEEF BLOOD PLASMA AS A POSSIBLE SUBSTITUTE FOR HUMAN BLOOD PLASMA[1]

SINCE racemization of protein is accompanied by loss of antigenicity, an attempt was made to use this process to deantigenate beef blood plasma with the possibility in mind of using the modified plasma as a therapeutic substitute for human plasma. Beef plasma treated for 15 days at 37° with sodium hydroxide in a concentration of 0.5 normal, after the manner described by Dakin[2] for the racemization of casein, yielded a product which, when neutralized, was highly toxic for guinea pigs on intravenous injection. This toxic action was reminiscent of the action of the anaphylatoxin produced by Vaughan[3] by the treatment of protein with an alcoholic solution of sodium hydroxide. Systematic reduction of the period of incubation of the alkaline plasma progressively reduced the toxicity. It was found that eight hours was the longest period which plasma could be treated without the development of toxic properties manifest on intravenous injection into guinea pigs. The longest period of treatment which gave a product that did not have a primary oxytocic action on the isolated uterus of a guinea pig was one hour. Beef plasma which had been incubated one hour or longer with 0.5 normal sodium hydroxide and then neutralized was no longer antigenic when tested by gross anaphylaxis or by the more sensitive method using uterine strips from guinea pigs sensitized to native beef plasma. Even a five-minute exposure to 0.5 normal alkali destroys most of the antigenicity of beef plasma.

Most of the protein of beef plasma that had been treated for one hour with alkali can be precipitated with acid at pH 4.3 and redissolved in alkali. It can also be precipitated with alcohol, dehydrated with acetone, and the dried powder redissolved in water. In neutral solution the protein can be heated without coagulation or apparent alteration of its properties. These facts form the basis of the procedure used in preparing large amounts of the modified plasma for physiologic experiments. Originally ultrafiltration was used to "wash" out the excessive salt formed from the neutralization of sodium hydroxide. This process is slow and bacterial contamination is difficult to avoid. At the present time the routine procedure is as follows. A special citrated beef plasma of low bacterial count is obtained in five-gallon lots (from Armour and Company through the courtesy of Dr. Julius D. Porsche). To each liter of the plasma is added 100 cc of 22 per cent. sodium hydroxide, both of which have been warmed to 37°. The mixture is placed in a 37° incubator for one hour, after which 1.0 normal hydrochloric acid is added slowly with brisk stirring until a reaction of pH 4.3 is reached. The precipitate is separated and washed with a citric acid-disodium phosphate buffer at pH 4.3. The precipitate is then finely suspended in about 700 cc of pyrogen-free distilled water and 30 cc of 22 per cent. sodium hydroxide added slowly as the suspension is vigorously stirred. The protein dissolves very rapidly and as soon thereafter as possible 1.0 normal hydrochloric acid is added until the reaction is pH 7.3–7.4. The volume is then made one liter. If the solution is turbid it becomes clear on warming. It is sterilized by passage through a Berkefeld filter. The final product is a slightly opalescent solution with the appearance and viscosity of serum. An alternative procedure is to neutralize the mixture when it is taken from the incubator and then add 4 volumes of 95 per cent. alcohol. The precipitate is washed several times with 95 per cent. alcohol and finally extracted with acetone until the filtrate is colorless. The protein, when dry, is a fluffy white powder from which solutions of a desired concentration can be prepared by adding saline and heating for about 15 minutes in an Arnold sterilizer. Beef serum can be used, as well as plasma, in the procedure described and gives a satisfactory end product. With serum the solution is lighter in color and can be more easily passed through a Berkefeld filter.

---

[6] M. Kenny and L. Colebrook, *Jour. Path. and Bact.*, 44: 91, 1937.

[7] To be published.

[1] From the Department of Pathology and the Otho S. A. Sprague Memorial Institute, University of Chicago.

[2] *Jour. Biol. Chem.*, 13: 357, 1912; 15: 263 and 271, 1913.

[3] "Protein Split Products," Philadelphia, 1913.

Experiments are under way (in collaboration with Dr. Howard C. Hopps) to find the therapeutic effect of the modified plasma on experimental shock. A normal dog given, while under ether anesthesia, 500 cc of the substance containing 5 per cent. protein showed no change in respiration and a slight rise in blood pressure apparently due to increased blood volume. Allowed to recover, this animal disclosed no untoward effect which might be attributed to the infusion. Dogs brought into shock by massive bleedings have been successively treated by infusion with the modified plasma. Their blood pressure is readily restored and they survive what otherwise would have been fatal shock. An animal used a second time in such an experiment, three weeks after the first experiment, likewise recovered and showed no effect that could be ascribed to a sensitization from the previous infusion.

It is generally believed that the loss of antigenicity which a protein undergoes when treated with strong alkali is due to racemization. The changes produced in beef plasma described above are apparently *not* due to racemization for the following reasons: (1) with complete racemization optical rotation is brought to an irreducible minimum. The optical rotation of modified beef plasma after one hour of treatment with 0.5 normal sodium hydroxide is but slightly altered; (2) with complete racemization the treated protein is no longer digestible by proteolytic enzymes or putrefactive bacteria. Modified beef plasma is readily digested by pepsin and becomes putrefied on standing exposed.

The cause of the loss of antigenicity from short exposure to alkali is not yet fully determined. During neutralization of the alkaline plasma a very strong odor of hydrogen sulfide is given off. This suggests the destruction of cystine and other sulfur-containing amino acids. It is possible that other amino acids, including those that are believed to be necessary for antigenicity of proteins, are also destroyed. If this be true the modified beef plasma may be considered analogous to gelatin which is produced by hydrolysis of collagen. Gelatin is deficient in certain amino acids, a fact which has been related to its lack of antigenicity.

JULIAN H. LEWIS

BOOKS RECEIVED

COONAN, FREDERICK L. *Principles of Physical Metallurgy.* Illustrated. Pp. xi + 238. Harper and Brothers. $3.25.

CRAIK, K. J. W. *The Nature of Explanation.* Pp. 123. Macmillan Company. $1.50.

CUMMINS, HAROLD and CHARLES MIDLO. *Finger Prints, Palms and Soles.* Illustrated. Pp. xi + 309. Blakiston Company. $4.00.

FRAPRIE, FRANK R. and FRANKLIN I. JORDAN. *The American Annual of Photography.* Illustrated. Pp. 248. American Photographic Publishing Co. $1.50.

GLASS, BENTLEY. *Genes and the Man.* Illustrated. Pp. xii + 386. Bureau of Publications, Teachers College, Columbia University. $3.50.

KOLMER, JOHN A. *Clinical Diagnosis by Laboratory Examinations.* Illustrated. Pp. xlii + 1239. D. Appleton-Century.

PRAY, LEON L. *Taxidermy.* Illustrated. Pp. viii + 91. Macmillan Company. $1.49.

TOMKINS, SILVAN S. *Contemporary Psychopathology.* Illustrated. Pp. xiv + 600. Harvard University Press. $5.00.

TURNER, C. E. *Personal and Community Health.* Illustrated. Pp. 585. C. V. Mosby Company. $3.50.

ZMESKAL, OTTO. *Radiographic Inspection of Metals.* Illustrated. Pp. x + 150. Harper and Brothers. $2.75.

SCIENCE

Vol. 98 FRIDAY, OCTOBER 29, 1943 No. 2548

Astronomical Problems of To-Day: SIR JAMES JEANS, F.R.S. 373

Science in China: CHUNG YU WANG 376

Obituary:
  Deaths and Memorials 379

Scientific Events:
  The Point System of Rationing; Rare Chemicals; The Finney-Howell Research Foundation; The Borden Award in Nutrition; Joint Annual Meeting of Scientific Societies in China; The Society of Chemical Industry 379

Scientific Notes and News 382

Discussion:
  Synapsis and Syngamy as Stimulating Processes of Plant Development: DR. A. E. MURNEEK and S. H. WITTWER. *Name and Classification of the Curly-Top Virus:* DR. EUBANKS CARSNER and DR. C. W. BENNETT. *The Preparation of Sodium Iodoacetate:* LEON GOLDBERG. *Isotel, Isotelic:* PROFESSOR ROGER J. WILLIAMS 384

Scientific Books:
  Soil Science: PROFESSOR G. B. BODMAN. *Termites:* CHARLES H. BLAKE 387

Special Articles:
  On the Mechanism of Insulin Action: Observations with Radioactive Phosphorus: DR. JACOB SACKS. *Sulfonamide Depression of Inorganic Catalytic Action:* PROFESSOR P. J. HANZLIK and PROFESSOR W. C. CUTTING. *Growth Stimulation by Ammonium Sulfamate in Low Concentration:* DR. F. FROMM 388

Scientific Apparatus and Laboratory Methods:
  A Cool Light for Dissecting Microscopes: DR. ROBERT L. PATTON 392

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

ASTRONOMICAL PROBLEMS OF TO-DAY[1]

By Sir JAMES JEANS, F.R.S.

PROFESSOR OF ASTRONOMY, THE ROYAL INSTITUTION

THIS evening I propose to discuss a group of problems relating to the central problem of the structure of the universe. No final or definite answers have yet been found for these, so that we shall be discussing questions rather than answers.

The earliest astronomy was geocentric, the earth being supposed to be the center of the whole universe. This view was not based on astronomical evidence but had its roots in man's self-esteem, in his want of imagination and in the meagerness of his scientific knowledge. It met its end in the arguments of Copernicus and in the observations of Galileo.

It was succeeded by what we may call a heliocentric astronomy, in which the sun was supposed to be at or near the center of the galactic system and possibly also of the whole universe. This view did not result from any human frailty; there seemed to be good scientific evidence for it.

For a superficial study of the sky shows that those stars that appear brightest to us, and so are presumably nearest to us, are scattered fairly uniformly in the different directions of space, while the Milky Way divides the sky into exactly equal halves and itself looks about equally bright in all its parts. All this seemed to indicate a disc-shaped system of stars, with the sun lying in the central plane of the disc and fairly close to its center. Such a view of the structure of the galaxy appeared to find confirmation in the pioneer researches of the two Herschels and in the later investigations of Kapteyn, Seares and others.

We know now that it was entirely wrong. It was wrong because these investigators had assumed that space was entirely transparent to light. We know now that the whole galactic system is permeated by a patchy fog of obscuring matter, which is not dense enough to affect the light of the nearer stars appreciably but blots out the more distant stars entirely. This fog makes the greater part of the galactic system invisible to us; if our predecessors thought they were at the center of the galactic system, it was as a man who is in a forest in a thick fog may think he is at the center of the forest, although in truth he is only at the center of the small group of trees he can see through the fog.

---

[1] Abstract of lecture before the Royal Institution of Great Britain, March 26, 1943.

We know now that the center of the galaxy is far removed from the sun and that the sun, like all the rest of the galaxy, is revolving round this distant center. Observation shows that the sun's period of rotation is about 250 million years and that its orbital speed is of the order of 270 kms. a second. These purely observational data show that the galactic center must be at a distance of about 36,000 light-years from the sun.

It used to be thought that our own particular galaxy was far larger than any other in the sky, but it is now clear that all galaxies are very similar in size and also very similar in mass. Our own galactic system can be weighed by calculating the gravitational force it exerts on the sun to keep this moving in the orbit already described; the requisite mass comes out at about 150,000 million suns. It is also possible to weigh a close pair or cluster of galaxies by calculating the gravitational force they must exert on one another so as to prevent the more rapidly moving members running away into space. The average mass needed usually comes out at about that just mentioned for our own galaxy, most estimates ranging from 95,000 million to 200,000 million suns. On the evidence at present available the galaxies seem likely to differ far less one from another than the stars of which they are composed, and we are led to picture the astronomical universe as consisting of a number of similar units—our own galaxy and the other galaxies—rather like the molecules of a gas.

On pointing a telescope in different directions in space we see fields of stars which differ greatly from one another, a consequence of the finite size and definite structure of the galaxy. No comparable variations are to be found in the fields of galaxies seen in different directions in space. Clusters may be seen here and there, also bare patches in places, but broadly speaking the galaxies seem to be scattered fairly evenly through space, the average distance of neighbors being something over a million light-years. We do not know whether this uniformity of distribution persists through the whole space or not, for the galaxies that we can see may perhaps form only a small part of some grander system, built on such a scale that no appreciable difference of structure occurs within the distances accessible to our telescopes.

If, however, the distribution is uniform through the whole of space, then space must be finite; otherwise it would contain an infinite amount of matter and the gravitational force from this would be infinite, which is contrary to the fact. This alternative, then, brings us to the type of universe which Einstein contemplated in his original relativity theory. Space is curved with a positive curvature—like the surface of the earth—and is filled with matter of which the average density is everywhere the same. On this theory the size of space is determined uniquely by the average density of matter, much as the size of an expanded balloon depends on the density, and so on the pressure, of the gas inside it. From the data already mentioned, we can deduce that the average density of matter in space must be of the order to 10^{-28} gms. per cu.cm., or about one atom to the cubic yard. With this density the radius of space must be about 3,300 million light-years—at least if the whole structure is at rest in a configuration of equilibrium. Thus the whole range of our biggest telescopes would be only a minute fraction of the size of space.

This seemed to provide a possible and consistent scheme until Friedmann and Lemaître showed that such a universe could not stand at rest in equilibrium. It would be unstable in the sense that space itself would have to start either expanding or contracting. Some time after this, Hubble and Humason found displacements in the spectra of distant nebulae which, if interpreted in the simplest way as Doppler effects, showed that the distant nebulae were all receding from us and suggested that space might actually be expanding just as Friedmann and Lamaître had predicted. Observation showed that the rate of expansion would be the same everywhere and such that, if it were maintained at its present value, the linear dimensions of space would be doubled in about 1,800 million years.

This in turn suggested that the universe might have started as an Einstein universe of the kind already described and that the inherent instability of such a configuration had caused it to expand to its present dimensions. But the theory of relativity could not deduce the present dimensions, either from the present density of matter or otherwise, Einstein's relation between size and density referring only to a universe at rest in equilibrium.

Eddington has claimed to solve the problem by quite different methods. In brief he believes that the total number of protons in the universe must be 136×2^{256}, there being also an equal number of electrons; he has produced arguments to show that there can not, from the nature of things, be anything other than this.

Knowing the number of particles in the universe and the mass of each, it is easy to calculate the total mass of the universe, and hence the dimensions, since we already know the average density to be about 10^{-28};

the radius of curvature comes out at some 2,000 or 3,000 millions of light-years. But if the universe started as an Einstein universe in equilibrium, then the total mass it contained—the known total mass of all Eddington's particles—would fix its curvature definitely and precisely. Eddington calculates that the radius of curvature would then be 1,068 millions of light-years. Thus the expansion of the universe up to the present can only have increased its dimensions some two or three fold, a process which would occupy only a few thousands of millions of years. This agrees well enough with what we know as to the age of the earth, for it seems probable that the earth came into existence between 2,000 and 3,000 millions of years ago, the sun then being at the very beginnings of its existences as a star. It also agrees with what we know as to the ages of the stars; if present conjectures as to the mechanism of stellar radiation are right, the stars can hardly have contained available energy to provide radiation for more than a very few thousands of millions of years.

The problem has been attacked on different lines by Milne, Dirac and others. After the geocentric and the heliocentric universes had been banished from astronomy, the apparent recessions of the nebulae seemed to suggest a galacto-centric universe, with our own galaxy as the center from which all others were moving radially away. Milne based his theory on what he described as the "cosmological principle"—the universe is not in any way centered in our galaxy; this occupies no specially favored position, so that the picture which an inhabitant of our galaxy draws of the large-scale features of the universe would be equally valid for any other galaxy.

With the help of this principle Milne draws a picture which seems at first sight to describe something totally different from the expanding universe of Friedmann and Lamaître. But Kermack and McCrea claim to have shown that the two pictures differ only in the way in which two maps of the same country differ when they are drawn on different projections—if we compare the relativity picture to a spherical projection, then Milne's picture may be compared to a Mercator projection. McVittie has recently claimed that Milne's results do not really depend on the cosmological principle at all, but can all be deduced from assumptions which Milne has unwittingly introduced under an erroneous impression that they are axiomatic. But all this is still under discussion.

Another line of investigation was opened by Dirac, possibly under the influence of a remark which Eddington made as far back as 1923.

Physics provides a natural unit of force, namely, the attraction between the nucleus and the electron in the hydrogen atom. Astronomy also provides a natural unit of force—the force with which the same two particles attract one another gravitationally. This latter unit is very small in comparison with the physical unit, the two standing in the ratio of 1 to 2.3×10^{39}. This is of course a pure number and so is independent of the particular units we use for our measurements. We have already mentioned another large number—the number of protons in the universe, which Eddington claims must be 1.57×10^{79}. The square root of this number is 3.9×10^{39} and so is very close to the ratio of the electric and gravitational forces just mentioned. Eddington and Dirac have both suggested that the agreement is too good to be the result of a mere coincidence; they prefer to think that it must result from some fundamental property of the universe.

Again physics provides a natural unit of time. It can be expressed in a variety of forms, the simplest being that it is the time light takes to travel across the diameter of an electron, about 1.25×10^{-23} secs. Astronomy also provides a natural unit of time; it is the fictitious time that the various galaxies would take to reach their present positions if they had all started simultaneously from a point and traveled uniformly at their present speeds of motion. This time is the same for all galaxies, being the 1,800 million years just mentioned. Again the ratio of these two units is a very large number; this time it is 4.5×10^{39}, which is very near to the large numbers already mentioned. Again we must assume that the agreement is not a mere accident but must represent something in the order of nature.

We do not know what is the explanation of these apparent coincidences, but they seem to conceal something which has not yet been fully explained and which, when fully understood, may prove to be of outstanding importance. It is true that Eddington's researches provide an explanation but only in a rather special and very recondite form; it looks as though this explanation is only a special case of something simpler and far wider.

Some investigators have gone further than this and traverse, as it seems to me, very dangerous ground. The age of the universe, expressed in terms of the natural physical unit of time, proves once again to be of the order of 10^{39} and the suggestion is made that this also can be no mere accident, but it must express something in the fixed order of nature. The weakness in this argument is, as it seems to me, that the basic fact on which it rests can be put in the simpler form that the age of the universe is some one, two or three times the time in which space doubles its dimensions and that, when it is so expressed, it is difficult to find any "coincidence," either real or apparent. The supposed coincidence is seen to be merely a simple transformation of one which has already been dealt with and we must not, so to speak, try to cash in on the same coincidence twice over.

Let us, however, waive the objection and accept the suggestion made. We have then to suppose that all the numbers of the order of 10^{39}, including the age of the universe, owe their approximate equality to something in the fixed order of nature. When the universe attains to 10 times its present age, the 10^{39} which measures its age will have increased to 10^{40} and all the other big numbers will have done likewise. Thus while the ratio of electrical to gravitational attraction will be ten times what it now is and so on, the number of particles in the universe will have increased 100-fold, so that creation must still be in progress. In brief, some or all of the quantities that we used to regard as unalterable constants of nature lose their quality of constancy and must change continually with the time. Milne was led to the same conclusion by a very different road; he reached it from a study of his cosmological principle. By whatever road we arrive, we come into a fantastic new world.

We may avoid the need for a continual creation of matter by supposing that the natural physical unit of time changes *pari passu* with the age of the universe. Then the measure of the age of the universe stays always the same as does also the number of particles in the universe. But now we find that either the mass or the charge of an electron must continually change.

All these seem strange to old-fashioned physics, but it simplifies some things and removes some difficulties. When, for instance, we study the spectrum of a nebula at 250 million light-years distance, we are in effect watching the emission of light from atoms as they were 250 million years ago. And a simple interpretation of what we see is that the atoms of those days were not the same as the atoms of to-day. Hydrogen atoms seem to have given out radiation of longer wavelength than they do now, and so were apparently larger—or perhaps their electrons moved more slowly in their orbits and so took longer to complete their revolutions, possibly because the electric attraction on them was less intense. There are many possibilities, each with its merits but also with many demerits.

Whatever the final solution of this vast problem may prove to be, it is already clear that there is no solution on the lines of the kind of dynamics that we learned at school. The mechanical interpretation of the universe fails as completely in the large-scale world of astronomy as it has already failed in the small-scale world of atomic physics. The quantum-theory has replaced mechanics in the physical world; we still do not know what is destined to replace it in the world of astronomy.

SCIENCE IN CHINA

By CHUNG YU WANG

COUNSELLOR, ACADEMIA SINICA; TECHNICAL EXPERT, MINISTRY OF ECONOMIC AFFAIRS

CHINA is, paradoxical as it may seem, the youngest and the oldest in science among the family of nations. The remark of Gore about Western civilization, that "the origin of many important discoveries lies buried in the obscurity of past ages," is none the less true of Chinese inventions and discoveries. It may be recalled that compass, paper, printing, glass, porcelain, gun-powder, etc., were discovered in China long before the time of Galileo, Bacon and Newton. In the realm of physical and biological sciences, some fundamental conceptions may be found buried in some Chinese ancient classics.

In the twelfth and thirteenth centuries, as a reaction against the "Subjective Philosophy" of Zennism, the "Rational Philosophy" of the Neo-Confucian philosophers was heralded in with the slogan "go to the things and investigate their reasons," a phrase as if taken out of Bacon's "Novum Organum." The greatest leaders of this movement were Chang I (1022 to 1107 A.D.) and Chu Hsi (1129 to 1200 A.D.). Chu Hsi wrote: "In every human mind, there is the knowing faculty; and in everything there is its reason. The incompleteness of our knowledge is due to our insufficiency in investigating the reason of things. The student must go to all things under heaven, beginning with the known principles, and seeking to reach the utmost. After sufficient labour has been devoted to it, the day will come when all things will suddenly become clear and intelligible" (translation by Dr. Hu Shih). This statement sounds quite modern in the sense that it may be construed to indicate the problem and procedure of what is now called science. Unfortunately, in the ensuing centuries, this movement, due to the introverted mentality of its leaders, had degenerated into a mere study of the classics of the ancients, and through centuries of classical education, by which, as Carlyle pertinently remarks, "they do attempt to make their Men of Letters their governors," the study of science was muffled and stifled.

The real awakening of China to the spirit and character of science, due undoubtedly to the impact of the return of Chinese students, trained both in pure and applied sciences in America and Europe, may be said to have begun only within the last twenty-five years, although desultory attempts to introduce western sciences into China had been made in times past. The interest and enthusiasm with which the Chinese are now leaning toward the pursuit of both pure and applied sciences may be gleaned from the fact that the percentage of students in higher institutions of learning in China, majoring in pure sciences, increased from 7.6 in 1928 to 13 in 1936, and that the percentage of students in both pure and applied sciences increased from 27 in 1928 to 43 in 1936; that is, within a period of about ten years the percentage of the number of students taking up either pure or applied sciences is about double.

The same trend of increase can be discerned in the number of Chinese students studying in the United States and Canada. The percentage of Chinese students studying both pure and applied sciences increased from 30 in 1934 to 50 in 1942, while that of Chinese students studying only pure sciences increased from 3 in 1934 to 10 in 1942.

More astonishing is the growth of learned societies and research institutes of both pure and applied sciences during recent years in China. Whereas before the establishment of the Chinese Republic in 1912, there were only a few insignificant so-called learned societies of sciences, in 1936 there were found fifty-three learned societies and research institutes for natural sciences and sixty-nine for applied sciences. Naturally, paralleling the growth of these societies and institutes, is the increase in the number of publications dealing with both pure and applied sciences. Thus there were published in 1936 forty-two different kinds of periodicals, bulletins or transactions, devoted exclusively to these sciences. However, it should be mentioned that not a few of these societies and publications, just mentioned, may seem mediocre in their activities and contents, if judged by the Western standard; yet, within only a span of about twenty-five years, they have fared pretty well as a whole in their contributions to science.

Science connotes research; and the research workers in science are mostly men trained in the higher institutions of learning. To borrow an apt analogy from Professor Pupin, it may be said "scientific and engineering research is the honey-gathering process; men trained and disciplined in this field of inquiry are the honey-gathering bees." Now it is gratifying to note that both the bee and the honey are in the process of becoming in Chinese higher institutions of learning. Before the present Sino-Japanese War, there were a hundred and eight institutions of higher learning, forty-two of which were universities, thirty-four independent colleges and thirty-two technological and professional schools. Since the war began in 1937, fifty-six Chinese universities and colleges have been moved into Free Chnia, seventeen have been suspended, while the remaining thirty-five institutions in occupied China have led a precarious existence and certainly not a few of them have been closed.

About less than fifty years ago there did not exist in China any institutions of learning worthy of the name of a university. In fact the first government university, wherein sciences were taught, of necessity, in a mediocre manner, was established in 1895. It is indeed remarkable that within this short span of years China has almost caught up with the other nations in the pursuit of sciences which has taken the United States about a century and the European countries about three centuries to reach the position in which they stand to-day. This urge on the part of the Chinese to take up science in such an accelerating rate has been in a large measure due to the catalytic action of both American and European scientific thoughts on the Chinese mind.

Foremost among the many scientific research institutions in China are the Research Institutes of the Academia Sinica and the Geological Survey of China.

The Academia Sinica was established as a government institution in 1927 and is constituted of eleven institutes; they are the Institute of Physics, the Institute of Chemistry, the Institute of Engineering, the Institute of Biology, the Institute of Astronomy, the Institute of Geology, the Institute of Meteorology, the Institute of Mathematics, the Institute of History and Philology, the Institute of Social Sciences and the Institute of Psychology. These various institutes have been removed to different parts of Free China since the commencement of the present Sino-Japanese War. Dr. Chiu Chia-hua is now acting president of the Academia Sinica.

The Institute of Physics, originally located in Shanghai, has been moved to Kweilin and Kunming. In addition to the manufacture of scientific instruments for educational institutions, construction of radio broadcasting equipment and the manufacture of vibrator rectifiers, it is now engaged in the design of super-hetero-dyne receivers with crystal filters, researches on terrestrial magnetism, and on the magnetic properties of ferro alloys and steels.

The Institute of Astronomy, now located at Kunming, is engaged in the following lines of research and activities: solar research, photographic studies of variables and comets, determination of latitudes and longitudes and the studies of star clusters in the galactic system, orbits and ephemerides of comets and planetoids.

The Institute of Meteorology in Chungking is now devoted to wartime military aeronautical needs. The projected activities of the institute are the establishment of additional observation stations in the northwestern and southwestern provinces, the study of long-range weather forecasts and the use of wireless meteorological instruments.

The Institute of Engineering, whose past work in the research of iron and steel has been suspended for lack of proper equipment, is now carrying on in Kunming some research work along the following lines: tungsten metallurgy, manufacture of glass and survey of raw materials for glass manufacture.

The Institute of Geology, under the able direction of Professor J. S. Lee, has been doing excellent work in the field of Chinese geology. His contributions to Chinese geology are numerous, but his most outstanding works are his "Studies of Graptolites" and his treatise on the "Geology of China," which latter has become a classic for students of Chinese geology.

Of all the different branches of science now passionately pursued in China, the science of geology bears the most fruitful results. The story of the accomplishments of Chinese scientists in geology during the last twenty-five years is alone sufficient to demonstrate the innate quality of Chinese mentality for science. It is remarkable that as early as 1200 A.D., Chu-Hsi, the Neo-Confucianist, made the following observation: "In high mountains there are shells. They probably occur in the rocks, which are the soil of older days, and the shells once lived in the water. The low places became high, and the soft mud turned into hard rock."

It was an event of no small significance when the Chinese Geological Survey was inaugurated in 1916. This event was brought about by two brilliant Chinese scientists, Dr. V. K. Ting, now deceased, and Dr. Wong Wen-hao, now Minister of Economic Affairs and chairman of the National Resources Commission, who, of verity, may be regarded as fathers of geological science in China. Time does not permit me to enumerate here the contributions of the many Chinese geologists in the fields of paleontology and stratigraphy and other branches of geology. They can be found in the bulletins, memoirs and paleontological monographs, the latter grouped under the name of Palaeontologia Sinica, published by the National Geological Survey of China. However, it is appropriate for me to mention at this juncture the name of my old teacher, Dr. A. W. Grabau, who has had a great deal to do with the training of young Chinese geologists, inspiring and guiding them in their researches.

Due to the emergency of the war in China, it is but natural for Chinese scientists and technologists to turn their energy and efforts in winning the war. The seventeen laboratories of the National Resources Commission are doing researches in raw materials, in industrial techniques and in better production methods. Experiments are being carried on in finding the magnum bonum condition for the distillation of alcohol from fibrous plants; tung oil, once a valuable product for export, is being processed to yield synthetic gasoline and rubber; motors of different descriptions are manufactured in the electrical laboratory; the machine shop laboratory is turning out machines of every description for the various industries.

One outstanding achievement of geological sciences since the outbreak of hostilities in China is the discovery of an immense oil field, northwest of Lanchow, the capital city of Kansu Province. It is estimated that the reserves of this field contain fully 140,000,000 barrels of crude, equivalent to about 1/130 of the oil reserves in the United States. Efforts are under way to produce 10,000 barrels per day.

Japan's war of aggression has precipitated an unprecedented mass migration of Chinese students, both boys and girls, and their professors to the hinterland of China. The epic of the odyssey of these intellectuals treking thousands of miles with their books and laboratory equipments, through trials and tribulations, requires abler pen than mine to describe. From this you may readily imagine the difficulties under which science is now being pursued in Free China. In spite of such difficulties, in lack of materials and equipments, studies of sciences are being carried on. To show you how the Chinese people appreciate the value of science, I would like just to mention the fact that the People's Political Council, a war-time national parliament, recently convened in Chungking in October of last year, passed a resolution to increase the appropriation for scientific and academic researches.

In conclusion, allow me to voice one of the many hopes of Chinese scientists with respect to their future work after the termination of this global war. You have been helping China as a member of the family of the United Nations in many ways during the progress of this war. We thank you. We, as your colleagues, however, dare to bespeak your future help in the rebuilding of our bombed-out universities, laboratories and libraries, as soon as the pseudo-divine barbaric mission of the Japanese is crushed. We hope we are not unworthy of your help. The Chinese scientists in the future will, with renewed energy and zeal, do their share, by laying a brick here and there, in the building up of the Temple of Science.

OBITUARY

DEATHS AND MEMORIALS

Dr. David H. Newland, state geologist of New York, who retired three years ago, died on October 18 at the age of seventy-one years.

Dr. Theodore Diller, psychiatrist for the Altoona, Pa., Army Induction Center, died on October 6 at the age of eighty years.

A correspondent writes: "Lieutenant Rolland F. Lang, of the civil engineering staff of the Michigan College of Mining and Technology, Houghton, was killed in action somewhere in the Southwest Pacific on October 7, a few days after his twenty-ninth birthday and fourteen months after he had been called to active duty as a reserve officer. Lieutenant Lang joined the faculty of the Michigan college three years ago. A graduate of South Dakota State College, he had taught at his alma mater for two years. He was a member of the American Society of Civil Engineers, the American Road Builders' Association, Scabbard and Blade, Blue Key, Delta Pi Chi Engineering Society and Kappa Delta Psi social fraternity. Both as a teacher and as a practising engineer, he was a young man of great promise; as an officer in the Army of the United States he had proved himself able and courageous."

The Alumnae Association of the Woman's Medical College of Pennsylvania announces the publication of a series of addresses delivered at a service in memory of the late Dr. Martha Tracy, dean of the college from 1918 to 1940. Copies of the booklet may be obtained from the Alumnae Office at the Woman's Medical College. Proceeds of the sale will be placed in the Tracy Memorial Fund.

SCIENTIFIC EVENTS

THE POINT SYSTEM OF RATIONING[1]

With the inauguration of a point system of rationing on March 1, 1943, the Office of Price Administration became the administrative agency; and the public's traditional peacetime latitude of dietary choice, limited only by ability to pay, was abruptly curtailed. As point rationing was extended to include a broad range of meats, fats and processed foods, it became evident that certain institutions and certain groups of the population would, because of special dietary needs, require special consideration. Prominent among these were hospitals and those sick individuals whose illness demands rationed foods in amounts greater than that provided by their "points." On the Food Distribution Administration of the Department of Agriculture developed responsibility for the equitable distribution of food and therefore responsibility for assuring the needs of the sick and of institutions caring for the sick.

Furthermore, it was recognized that in recent years great advances have been made in the understanding of the vital role that dietary components play in the body economy under conditions of health, stress, disease and convalescence. The role of these components can be evaluated with increasing precision in the light of modern nutritional research. Therefore in April, 1943, at the request of Roy Hendrickson, director of the War Food Administration, Dr. Ross G. Harrison, chairman of the National Research Council, appointed a group of nationally known physicians to advise the War Food Administration concerning the extent of these special needs and the best method of meeting them.

Within the Division of Medical Sciences of the council this group was organized as the Subcommittee on Medical Food Requirements under the general jurisdiction of the Committee on Drugs and Medical Supplies, of which Dr. Walter W. Palmer, of Columbia University, is chairman. The subcommittee was composed of physicians representing various fields of medicine and consisted of Dr. William Stroud, Philadelphia, *chairman;* Dr. Cecil Striker, Cincinnati; Dr. Alton Ochsner, New Orleans; Dr. C. W. Munger, New York; Dr. Clark Finnerud, Chicago; Dr. Gilbert Levy, Memphis, and Dr. Walter W. Palmer (*ex officio*), New York. A first meeting was held in Washington on April 30 and May 1 at which the broad outlines of the problems involved were reviewed and discussed. At this and at subsequent meetings, representatives of the Civilian Food Requirements Branch, War Food Administration, and of the Food Rationing Division, Office of Price Administration, were present to acquaint the subcommittee with administrative aspects of the rationing program. Other committees of the National Research Council were called in consultation, notably the Committee on Surgery and the Subcommittee on Tuberculosis. The opinions of individual specialists in certain fields of medicine were solicited. Finally all recommendations of the subcommittee were reviewed and approved by the parent Committee on Drugs and Medical Supplies before transmission to the War Food Administration.

---

[1] The *Journal* of the American Medical Association.

RARE CHEMICALS

The following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

p-Aminophenylarsenoxide
Arsenophenylglycineamide
Halarsol
Halarsol thioglycollate
Arsacetin, reduced
Atoxylthioglycollate, reduced
Stovarsolthioglycollate, reduced
1,3,5-Triaminobenzene trihydrochloride
Diphenyl selenium difluoride $(C_6H_5)_2SeF_2$
Di-p-tolyl selenium difluoride $(CH_3C_6H_4)_2SeF_2$
Dodecyl amine hydrochloride
Dodecyl amine acetate
Adenosinetriphosphate
Adenosinediphosphate
Adenylic acid (muscle) up to 25 grams
Inosine
Spermine (2 grams)
Spermidine (2 grams)
Trypansamidethioglycollate, reduced

THE FINNEY-HOWELL RESEARCH FOUNDATION

Announcement has been made by the Finney-Howell Research Foundation, Inc., that all applications for fellowships for next year must be filed in the office of the foundation, 1211 Cathedral Street, Baltimore, Md., by January 1, 1944. Applications received after that date can not be considered for 1944 awards, which will be made March 1, 1944.

This foundation was provided for in the will of the late Dr. George Walker, of Baltimore, for the support of "research work into the cause or causes and the treatment of cancer." The will directed that the surplus income from the assets of the foundation together with the principal sum should be expended within a period of ten years to support a number of fellowships in cancer research, each with an annual stipend of two thousand dollars, "in such universities, laboratories and other institutions, wherever situated, as may be approved by the Board of Directors."

Fellowships carrying an annual stipend of $2,000 are awarded for the period of one year, with the possibility of renewal up to three years; when deemed wise by the board of directors, special grants of limited sums may be made to support the work carried on under a fellowship.

Applications must be made on the blank form which will be furnished by the secretary or any member of the board of directors.

THE BORDEN AWARD IN NUTRITION

This award is given in recognition of distinctive research by investigators in the United States and Canada which has emphasized the nutritive significance of the components of milk or of dairy products. The award will be made primarily for the publication of specific papers, but the judges may recommend that it be given for important contributions over an extended period of time. The award may be divided between two or more investigators. Employees of the Borden Company are not eligible for this honor.

To be considered for the award, nominations must be in the hands of the chairman of the nominating committee by February 1, 1944. The nominations should be accompanied by such data relative to the nominee and his research as will facilitate consideration for the award.

Henry A. Mattill,
Chairman of the Nominating Committee
The State University of Iowa,
Iowa City, Iowa

JOINT ANNUAL MEETING OF SCIENTIFIC SOCIETIES IN CHINA

A joint annual meeting of the Science Society, the Zoological Society, the Botanical Society, the Meteorological Society, the Mathematical Society and the Geographical Society of China was held at Pehpei, Chungking, on July 18, 19 and 20. Despite the hot weather prevailing then, 240 members attended the meeting, which was presided over by Dr. Wong Wen-hao. In his opening address Dr. Wong said that a joint meeting like this was especially desirable in wartime, in that it is economical in time, labor and expenditure and enhanced cooperation between societies of a related nature. In view of the present tendency to overlook the study of pure science, Dr. Wong remarked that truth is what the scientist values most, regardless of whether or not practical use can be derived from it; and he urged the pure scientists to be firm in their stand. As a geologist and Minister of Economic Affairs, he illustrated with first-hand examples to show how what appeared to be purely a geological study at first, turned out later to be of much practical value in the detection of China's natural resources. The address of the Generalissimo was then read, in which he declared: "Pure science is the foundation of all applied sciences. If we wish to stand up among the modern great nations there must not be the slightest tardiness in the prosecution of pure science." While most of the official emphasis has been laid on the practical side in the recent tide of national industrialization, it will do the nation good to remind people of the significance of pure science.

In the business meeting, held on the first afternoon, Dr. J. Needham, F.R.S., was elected honorary member of the Science Society of China, in appreciation of his distinguished academic work and his service in Sino-Western Science Cooperation which has been so effectively carried on during the past six months.

The six societies spent two forenoons in communicating original papers of their respective sciences. More than three hundred papers were read. Brief abstracts of these papers will be published before long in Chinese with additional English titles.

One of the two remaining afternoons was devoted to discussing the topic, "Science and National Reconstruction," with special reference to the problem of how science is to be promoted in China. Opinions were formulated on the following four points, which were presented to the Chinese government for their immediate adoption.

(1) The government is requested to provide a large fund in the forthcoming national budget for, and only for, the furtherance of scientific research and of the scientific education of the masses.

(2) The personnel and equipment of the leading science institutes, such as those of Academia Sinica, must be materially augmented.

(3) Efforts must be made on the part of the Government to establish cooperation between the scientists on the one hand, and the officials in charge of the planning of national reconstruction on the other, so as to render the resulting plans all the more practical and fruitful.

(4) While the Government is considering sending a large number of young scientists abroad, it is deemed appropriate that such opportunities should be extended to mature scholars also. Here again, the Government is requested not to neglect pure science in favor of applied sciences and technology.

The last afternoon of the meeting was reserved for a discussion on "International Science Cooperation." To familiarize the audience with the subject under discussion, four specialists were asked to talk about the cooperative measures hitherto undertaken, along with the sound results accomplished therefrom, with respect to agriculture, industry, meteorology, medicine and public health. Dr. Needham's address, entitled "International Science Cooperation in War and Peace," was read next by Dr. H. C. Zen, president of the Science Society of China, in which the present position of Sino-Western Science Cooperation of the United Nations in the Asiatic theater was reviewed. He urged, above all, that Science Cooperation Service should be made a regular part of the forthcoming United Nations Relief and Reconstruction Board. The members were unanimous in the opinion that international science cooperation, founded on international understanding and good-will, is worth striving for. Indeed, the Chinese scientists seek cooperation with no less enthusiasm than their friends of the West.

The meeting was concluded at nightfall on July 20. A scientific exhibition intended for the public was arranged by the societies during the session.

THE SOCIETY OF CHEMICAL INDUSTRY

Wallace Patten Cohoe, of New York, was inducted as president of the Society of Chemical Industry, the international organization with headquarters in London, at a dinner meeting held on October 22 at the Waldorf-Astoria. About eight hundred chemists and industrialists, including heads of America's leading chemical industries, attended. The meeting was under the patronage of King George VI. The British Government was represented by Sir Gerald Campbell, K.C.M.G., British Minister at Washington, who presented the chains of office to Mr. Cohoe and delivered an address.

The event was a continuation of the proceedings of the annual meeting of the society held in London on July 9, at which Mr. Cohoe was elected president to succeed Dr. William Cullen, of London, and which was adjourned to reconvene in New York City. A cable message of felicitation from the council of the society assembled in London and signed by Dr. Cullen was read at the dinner, at which Mr. Cohoe delivered the inaugural address. Dr. Foster D. Snell, head of Foster D. Snell, Inc., of Brooklyn, and chairman of the American section of the society, presided.

Honorary membership in the society, by order of the council in London, was bestowed on Academician Alexei Bach, Soviet biochemist, and Dr. Te-Pang Hou, Chinese industrial chemist. These were conferred by Mr. Cohoe. The citations were as follows:

Academician Alexei Bach: In commemoration of his lifelong activities as a research worker in the realm of biochemistry, which branch of chemical science he has enriched by his pioneering work.

Born in 1857, he is a member of the Academy of Sciences, which controls the researches of many thousands of workers who are engaged mainly on fundamental problems. Together with Professor Zbarsky he established the Chemical Institute, named after L. Karpov, and is now its director. In 1920 he established the Biochemical Institute under the People's Commissariat for Health, and both prior to this and since he has been responsible for many original scientific papers which have won for him and his coworkers international renown.

The council, in deciding to bestow this honor, selected with great care one whom they considered worthy, for in addition to his manifold contributions to our knowledge, he has through his long life shown unselfish devotion to science. Moreover, his career illustrates to a remarkable degree the beneficial influence which a man of high scientific attainments can have on the general life of a community.

Dr. Te-Pang Hou: In recognition of his distinguished pioneer services in establishing in China those chemical industries essential to the industrial life of a modern nation.

Born in Foochow, China, in 1890, he is a life member of the Chinese Institute of Engineers and medalist thereof "for the greatest contribution to the Chinese Chemical Industry"; life member of the Science Society of China; bachelor of science, master of arts and doctor of philosophy; and author. Respected in China for his chemical ability and successful achievements, he has by his personality, energy and distinguished position been able to inspire and lead his fellow countrymen to greater technological accomplishment.

The council, in deciding to bestow this honor, is conscious that Occidental Nations are indebted to the ancient Chinese civilization for their first knowledge of silk, paper, printing, porcelain, gunpowder and the magnetic compass, and has selected with great care this distinguished son of China who has carried Western chemical science to his own country, thus enabling the West to repay, in part, a debt, centuries old, to the Chinese nation.

SCIENTIFIC NOTES AND NEWS

AT the Chicago meeting of the American Institute of Mining and Metallurgical Engineers the William Lawrence Saunders Gold Medal was presented to George B. Harrington, president of the Chicago, Wilmington and Franklin Coal Company, for "distinguished achievement in mining." The Anthony F. Lucas Medal was presented to Charles V. Millikan, chief petroleum engineer of Amerada Petroleum Corporation, in recognition of "his contributions to engineering in the development and production of petroleum."

DR. GILBERT E. DOAN, head of the department of metallurgical engineering of Lehigh University, and his two associates, Dr. John Frye and Robert Stout, have received the Lincoln Award of the American Welding Society in recognition of research "representing the greatest contribution to the advancement and use of welding for the year 1943."

DR. FRED C. KOCH, Frank P. Hixon distinguished service professor of biochemistry, emeritus, of the University of Chicago, was the guest of honor at a dinner on October 1, given by the Chicago Section of the American Institute of Chemists. He was presented with a scroll enumerating his many contributions to science.

The Psychological Bulletin reports that the establishment of a new loan fund at Ohio University, to be known as the "James P. Porter Loan Fund in Psychology," was announced recently by Dr. A. C. Anderson, professor of psychology, who headed a committee to formulate plans to honor Dr. Porter on his recent retirement from the teaching faculty. The money for the loan fund was contributed by former students and by members of the staff of the department. At a dinner, Dr. Porter, who joined the faculty of Ohio University as professor of psychology in 1922, was presented with a book of letters from former students. For many years he was editor of *The Journal of Applied Psychology*.

A SKETCH of the career of Dean Emeritus Mortimer Elwyn Cooley, of the College of Engineering of the University of Michigan, is given in the July number of the *National Engineer*. It includes an article by Dean Cooley, entitled "Reminiscences of a Pioneer Engineer and Educator." The Mortimer E. Cooley Bridge, between Cadillac and Manistee, Michigan, and the Mortimer E. Cooley Foundation of Engineering were named for Professor Cooley.

THE Grocery Manufacturers of America have chosen Sir John Boyd Orr, who was largely responsible for improving the nutritive quality of the English diet in the face of wartime food shortages, as the 1943 recipient of its annual award. The presentation ceremony will be broadcast on November 4 over a two-way transatlantic hookup by the Blue Network at the war conference of the manufacturers in New York City. Surgeon General Thomas Parran, of the U. S. Public Health Service, has been invited to present the award in an address at the conference. Sir John will accept it over the air from England.

OFFICERS of the American Society for Metals have been elected as follows: M. A. Grossmann, director of research of the Carnegie-Illinois Steel Corporation, *President;* Dr. Kent R. Van Horn, research metallurgist of the Aluminum Company of America, Cleveland, *Vice-president,* and Harry D. McKinney, vice-president and works manager of the Driver-Harris Company, Harrison, N. J., *Treasurer.* William H. Eisenman will continue as national secretary of the society.

DR. HAROLD C. WIGGERS has resigned as assistant professor of physiology at the Medical School of Western Reserve University to become associate professor of physiology in the College of Medicine of the University of Illinois in Chicago.

DR. MAX MYER WINTROBE, formerly associate professor in the department of medicine at the Johns Hopkins University, has become professor of internal medicine and head of the department of the School of Medicine of the University of Utah.

DR. WILLIAM I. MYERS, head of the department of agricultural economics and farm management and acting dean since the death of Carl E. Ladd on July 23, has been appointed dean of the New York State College of Agriculture, Ithaca, N. Y.

Dr. **John Laurence Kask**, formerly assistant director of the International Pacific Salmon Fisheries Commission, has been appointed associate curator of fishes of the California Academy of Sciences.

The Desert Museum at Palm Springs, Calif., which was closed for the summer on May 15, was opened on October 16. The curator, Sam Hinton, having been appointed head of the department of hematology in the Medical Hospital (Torney Hospital) at Palm Springs, Professor and Mrs. T. D. A. Cockerell have taken charge of the museum.

Vernon E. Brock, biologist with the Department of Research of the Fish Commission of Oregon, has been given leave for the duration of the war to become assistant to the administrator of fishery production and fishery analyst in the Office of the Coordinator of Fisheries. His headquarters are in San Francisco, where he is engaged in the administration of the California sardine fishery.

C. Max Hull, for the past eight years a research chemist with the Standard Oil Company of Indiana, has been appointed research associate in the Research Foundation, Ohio State University.

Dr. **Charles F. McKhann** has resigned as professor of pediatrics and communicable diseases at the Medical School of the University of Michigan and as professor of maternal and child health in the School of Public Health, to become assistant to the president of Parke, Davis and Company. He will devote his time entirely to the scientific activities of the company.

William S. Richardson has been named head of the newly established chemicals division of the B. F. Goodrich Company at Akron, Ohio.

The American Philosophical Society has made a research grant of $1,000 to Dr. Herbert C. Brown to further his studies of steric strains as a factor in the stability of addition compounds. Dr. Brown recently joined the faculty of the College of Liberal Arts at Wayne University as assistant professor of chemistry. He is now coordinator and consultant for an Army research project being carried out by the University of Chicago and the Ethyl Corporation.

Dr. **Howard C. Naffziger**, professor of surgery in the Medical School of the University of California, has returned to San Francisco after making a survey of military medicine in England, Scotland, Sicily, North Africa and the Near East.

Captain **Winchell M. Craig**, U. S. Naval Reserve, chief surgeon at the Naval Hospital, Bethesda, Md., will deliver the W. J. and C. H. Mayo Memorial Lecture at the Medical School of Dartmouth College on November 5. The title of his address will be "Warriors against Disease."

Dr. **C. H. Mathewson**, chairman of the department of metallurgy of Yale University, gave the Campbell Memorial Lecture of the American Society for Metals, following the annual meeting.

The Thomas William Salmon Lectures will be given on November 5, 12 and 19 at the New York Academy of Medicine by Dr. Abraham Arden Brill, lecturer on psychoanalysis at Columbia University. His subject will be "The Psychotherapeutic Contribution to Psychiatry."

The American Association of Physics Teachers will hold its thirteenth annual meeting jointly with the American Physical Society at Columbia University from January 13 to 15, 1944. Headquarters will be at the Hotel Pennsylvania. The third Richtmyer Memorial Lecture will be delivered at this meeting and the presentation of the Oersted Medal will be made. There will be joint sessions with the American Physical Society, invited and contributed papers, exhibits of newly developed instructional equipment and the annual business meeting. Professor R. C. Gibbs, of Cornell University, is chairman of the program committee. Members who desire to contribute papers (10 minutes) or exhibits to the program are asked to send titles and abstracts not later than November 20.

Authorities on public health from six Latin American universities are visiting the United States under the auspices of the Office of the Coordinator of Inter-American Affairs and the Pan-American Sanitary Bureau in Washington, D. C. After a tour of schools of public health, members of the deputation will conclude their visit to the United States with presentation of a report on South American public health schools at the annual meeting of the Association of Schools of Public Health to be held at the University of Michigan on November 7. At the same time a plan for the interchange of students, offering the facilities of their universities for the study of tropical diseases, will be presented. Dr. Oscar Vargas, San Jose, Costa Rica, representing the Pan-American Sanitary Bureau, is acting as leader of the group. The other members include: Alberto Zwanck, professor of hygiene at the University of Buenos Aires; A. H. dePaulo-Souza, professor of public health at the University of São Paulo, Brazil; Carlos Enrique Paz-Soldan, professor of hygiene at the University of San Marcos, Lima, Peru; Federico J. Salveraglio, professor of hygiene at the Medical School, Montevideo, Uruguay; Mario Prado, vice-director of the Institute of Bacteriology, Santiago, Chile; and Hernan Romero, professor of preventive medicine and public health at the University of Chile, Santiago.

A CONFERENCE on geodesy, aeronautical charts and topographic maps in which twenty-five distinguished visitors from Latin America and Canada took part, was held recently in Washington. The conference was sponsored by the American Geographical Society at the suggestion of the Committee on Cartography of the Pan-American Institute of Geography and History, of which Pedro C. Sanchez is director. Dr. Andre C. Simonpietri is the secretary of the Commission on Cartography. Headquarters are in Mexico City. The purpose of the committee is to promulgate uniform standards and technical methods which can be adopted by all the countries involved; to improve education and training in the science of map making through the exchange of professors and technical personnel. Reports are being compiled in each country to indicate the status of mapping, complete with index charts showing geodetic control, completed and under way. Biographical data are being assembled on those engaged in cartographic work in each country and a glossary of scientific terms used in mapping is being prepared in English, Spanish and Portuguese. Following the conference in Washington the delegates inspected the production of aerial mapping equipment by the Bausch and Lomb Optical Company.

As reported by Science Service, cultural leaders in the Western Hemisphere recently met in Washington in wartime session to consider how best to promote scientific and scholarly cooperation. The Inter-American Committee on Intellectual Cooperation, under the chairmanship of Dr. Miguel Azorio de Almeida, Brazilian physiologist, is a Western Hemisphere regrouping of the national committees on intellectual cooperation that were organized under the League of Nations a decade ago. Conferences were held in the buildings of the Pan American Union and the Carnegie Endowment for International Peace, with those organizations and the Division of Cultural Relations of the State Department cooperating in the program. Dr. Waldo G. Leland, director of the American Council of Learned Societies, recently named chairman of the American Committee on Intellectual Cooperation, has been instrumental in arranging the conference. The American delegate to the meeting is Dr. James T. Shotwell, of Columbia University, now honorary chairman of the American committee. Other delegates are Dr. Victor Lascano, of Argentina, Dr. Julian Nogueira, of Uruguay, Dr. Alfonso Reyes, of Mexico, Dr. Cosme de la Torriente y Peraza, of Cuba, and Dr. Oscar Vera, of Chile. Dr. Herminio Rodriguez is secretary of the committee. Technical experts present included Dr. Robert Valeur, of New York, Dr. Mariano Brull, of Cuba, and Dr. Antonio Castro Leal, of Mexico.

THE Earl E. May Seed Company has made a gift of $75,000 to Iowa State College, to be spent over a period of five years, for a study of the basic problems relating to the growth and development of the corn of Mexico and Central and South America, and the contribution the corn of those areas may be able to make to the United States.

IT is reported in *Chemical and Engineering News* that a National Security Award has been established by the Office of Civilian Defense to give recognition to outstanding achievements of certain essential facilities in protecting the safety of employees, plants and production schedules from air raids, fire, sabotage and accident. A Board of Review has been formed to pass final judgment on records of plants nominated for the award.

A UNITED PRESS dispatch reports that the Swedish Government has decided against the awarding of Nobel prizes for peace, literature, physics, chemistry or medicine in 1943.

DISCUSSION

SYNAPSIS AND SYNGAMY AS STIMULATING PROCESSES OF PLANT DEVELOPMENT[1]

THE structural features of sexual reproduction in higher plants have been worked out and described with great precision, yet very little is known of the physiological aspects of this very important phase of their life. This despite the fact that most of the economic plants are grown for their seeds and fruit—organs and tissues associated directly or indirectly with reproduction. Even a cursory observation of many species, especially the annuals, should convince one that sexual reproduction has a very marked effect on growth and development, certain important aspects of which are now being recognized and studied.

In a series of experiments, chiefly with horticultural plants, the effects of developing flowers and fruit on vegetative growth have been amply demonstrated by the senior author,[2] which leaves little doubt about the conspicuous physiological control that these organs exert on metabolism. The influence, characterized by various degrees of inhibition in the subsequent dedevelopment and function of flowers, leaves, shoots and roots, is shown most markedly after reproduction has progressed towards completion, *viz.*, fruit and seed formation.

---

[1] Contribution from the Department of Horticulture, Missouri Agricultural Experiment Station Journal Series No. 909.

[2] A. E. Murneek, *Plant Physiol.*, 1: 3–56, 1926; 7: 79–90, 1932. *Mo. Agr. Exp. Sta. Res. Bul.*, 106, 1927. *Proc. Am. Soc. Hort. Sci.*, 21: 274–276, 1924; 40: 201–204, 1942. *Growth*, 3: 295–315, 1939.

An examination in detail of some of the earlier, very significant though less evident, stages of reproduction has disclosed, that, in addition to an inhibitory or retarding influence, as is exhibited during fruit and seed development, a more or less specific stimulation also occurs with initiation of fruit development and the early stages of fruit setting.[3] Hence coincident with sexual reproduction, vegetative growth is first stimulated and later retarded, in tandem order as it were.

The concept that, as a result of gametic union, *growth is stimulated was introduced and demonstrated* some time ago (Murneek, 1926),[3] while later observations suggested a similar stimulation during synapsis (Murneek, 1937).[3] As a result of further study of the problem we have now on record considerable proof, details of which will be presented in a forthcoming publication, that during the process of sexual reproduction metabolism is indeed accelerated, specifically at the approximate time of union of the chromosomes at meiosis (synapsis) and during union of nuclei at fertilization (syngamy). The two periodic stimulations in growth, therefore, have their origins in the process of fertilization with its two cytogenetically important phases, chromosome conjugation and gametic union, accepting the view long current that synapsis is the final or culminating phase of the sexual process, and disconsidering for the present exceptional cases or alternating mechanisms, as in certain polyploids or parthenogenetic organisms (Sharp, 1937).

It has been possible for us to demonstrate repeatedly by means of removal of reproductive organs at different stages of their development from a variety of plants (spinach, cucumber, strawberry and sour cherry) that a period of renewed growth, presumably arising from increased metabolic efficiency of the roots and leaves, follows each of the above two crucial phases of reproduction. These intervals of accelerated activity in the plant manifest themselves by increases in vegetative extension, the production of fresh and dry matter, the absorption of soil nutrients, and the accumulation of products of photosynthesis. In inflorescences of many plants the post-synaptic and post-syngamic periods are characterized by an augmented elongation and changes in movement of the pedicels. Two spurts in growth and alterations in movement usually occur, one during bud development, the other following fertilization of the egg.

Determinations of catalase activity in developing flowers and accessory tissues of the pear tree and corn plant showed two prominent peaks. The first increase followed synapsis in the microspore mother cells, the second occurred after nuclear fusion in the majority of the embryo sacs.

Following the initiation of chromosome conjugation in the staminate and fertilization in the pistillate flowers of corn, substances possessing marked growth stimulating properties (growth hormones) were produced, the greatest concentration being attained within the tassels 10 to 14 days after beginning of synapses, and in immature kernels an equal period subsequent to syngamy. The pre-synaptic stage in the male and the pre-syngamic period in the female inflorescences were distinguished by an absence of growth substances *in the respective reproductive organs*. The two maxima representing hormone concentration correspond quite precisely with (a) the peaks in catalase activity, and (b) the spurts in growth following gametophyte and embryo inception.

Extracts of the immature corn kernels, applied in lanolin paste, were active in fruit setting and parthenocarpic fruit induction in the tomato. The set, yield and size of the fruit were superior to that obtained by means of artificial pollination and by the use of synthetic growth substances.

These results have an unexpected confirmation and permit the interpretation of certain heretofore unintelligible results secured by Kreusler and his coworkers on the growth of the corn plant and published some 60 years ago.[4] A critical reexamination of their data and consideration of the time factor in morphogenesis of the corn plant reveal a striking correlation between (a) periods of greatest vegetative extension, accumulation of dry matter, absorption of soil nutrients and accumulation of photosynthetic products (Kreusler's data) and (b) peaks in production of growth hormones in the reproductive organs, as disclosed by our studies. The intervals of maximal increase in stimulating substances followed closely in all cases the beginning of synapses in the flower buds and embryo initiation in the young fruit.

A. E. MURNEEK
S. H. WITTWER

UNIVERSITY OF MISSOURI

NAME AND CLASSIFICATION OF THE CURLY-TOP VIRUS

SYMPTOMS induced in affected plants are the best characteristics now known for the classification of phytopathogenic viruses. The symptoms induced in beets as well as in other hosts by the curly-top virus complex would lead to the placing of this virus in the leaf-curl group described by Holmes[1] as the family *Rugaceae* with the one genus, *Ruga*. Holmes has placed the curly-top virus in the yellows group, the family *Chlorogenaceae*, and in the single genus, *Chlorogenus*, but the symptoms induced by the curly-top virus have little in common with those used to describe the family *Chlorogenaceae*.

---

[3] A. E. Murneek, *Mo. Agr. Exp. Sta. Res. Bul.*, 90, 1926. SCIENCE, 86: 43–47, 1937. S. H. Wittwer and A. E. Murneek, *Proc. Am. Soc. Hort. Sci.*, 40: 205–208, 1942.

[4] U. Kreusler, *et al.*, *Landw. Jahrb.* 6: 759–786, 787–800, 1877; 7: 536–564, 1878 and 8: 617–622, 1879.

The specific epithet, *eutetticola*, is in error from an orthographic viewpoint because the proper root for the first member should have been *eutettig-*. The specific epithet should, therefore, be changed. Changing the specific epithet affords the opportunity to choose a term that characterizes the curly-top virus and is not out of accord with present knowledge. The specific epithet, *eutetticola*, was assigned by Holmes to the curly-top virus when no other vector was known except the beet leafhopper, *Eutettix tenellus* (Baker). It is now known that this leafhopper failed to transmit the variety of the curly-top virus that occurs in Argentina. Another vector, *Agalliana ensigera* Oman, serves as vector there.

Because the curly-top virus causes in sugar beet and other host plants arrested development of invaded tissues, leaf curl, enations and other deformities rather than the symptoms used to describe the genus *Chlorogenus*, we propose that the curly-top virus be shifted to the genus *Ruga*. And, in view of the fact that the virus causes rough, pointed enations on the veins and rough distortion of the leaves and also in view of its vector relationships, we propose that its specific epithet be changed to *verrucosans*, to mean causing rough swellings. The name of the curly-top virus then will be *Ruga verrucosans*.

Detailed studies on the Argentine curly top will be published later in a more extensive paper.

EUBANKS CARSNER
C. W. BENNETT
DIVISION OF SUGAR PLANT INVESTIGATIONS,
U. S. DEPARTMENT OF AGRICULTURE,
RIVERSIDE, CALIF.

THE PREPARATION OF SODIUM IODOACETATE

IN a recent issue of SCIENCE[1] there appeared a request for sodium iodoacetate in the section devoted to "Rare Chemicals." It is difficult to obtain this reagent in pure form by the procedure customarily employed.[2] The present note describes a simple method for preparing pure sodium iodoacetate in good yield from monochloroacetic acid.

Monochloroacetic acid (10 gm) is dissolved in pure dry acetone (150 ml) containing sodium iodide (24 gm). The solution turns brown and separation of sodium chloride begins almost immediately. The reaction is complete in 6 to 8 hours at room temperature. The sodium chloride is removed by filtration through sintered glass and washed with a little acetone. The combined filtrates are adjusted to pH 6.8, using 40 per cent. sodium hydroxide. The precipitate which separates is filtered and washed with acetone, with chilled absolute alcohol and finally with dry ether. The product is powdered and dried *in vacuo*. It is quite colorless and free from halide ion. Yield: 20 gm (91 per cent.).

LEON GOLDBERG
SOUTH AFRICAN INSTITUTE FOR
MEDICAL RESEARCH,
JOHANNESBURG

ISOTEL, ISOTELIC

IT is surprising that no one has previously suggested (so far as the writer is aware) the use of the term *isotelic* (Gr. isos = same; telos = purpose) to designate the relationship between entities which have the same purpose.

The familiar term *isomer* (pl. isomers) is used in chemistry to designate compounds made up of the same parts (Gr. isos = same; meros = part). In an exactly analogous way it seems logical and convenient to designate compounds which perform the same function as *isotels* (Gr. isos = same; telos = purpose).

In biochemistry the need for such terms appears real in view of the fact that numerous cases can be cited of distinct chemical compounds which can replace one another, for example, in the diet. Thus there are numerous *isotelic* forms (*isotels*) of vitamin D as well as other vitamin *isotels* (including biotin *isotels*).[1] In animal nutrition methionine and choline may be said to be partially *isotelic*. In yeast nutrition β-alanine and pantothenic acid may be said to be *isotelic*, since one may replace the other in nutrient media.

The term *vitamer* has been suggested[1] to designate vitamin forms which can replace one another. This term was obviously suggested also by the word isomer. Unfortunately, however, the wrong portion of the word isomer was used and as a result *vitamer*, aside from having a mixed Latin and Greek origin, has a definite but false etymology, meaning, life-part. This is meaningless so far as the proposed use of the term is concerned.

ROGER J. WILLIAMS
THE UNIVERSITY OF TEXAS,
BIOCHEMICAL INSTITUTE, AND
CLAYTON FOUNDATION FOR RESEARCH,
AUSTIN

---

[1] F. O. Holmes, "Handbook of Phytopathogenic Viruses." Burgess Publishing Company, Minneapolis, 1939.

[1] SCIENCE, 97: 304, 1943.

[2] W. A. Drushel and G. S. Simpson, *Jour. Am. Chem. Soc.*, 39: 2453, 1917.

[1] D. Burk and R. J. Winzler, SCIENCE, 97: 2507, 57–60, January 15, 1943.

SCIENTIFIC BOOKS

SOIL SCIENCE

Fundamentals of Soil Science. By C. E. Millar and L. M. Turk. Pp. xi + 462. 56 tables and charts, 78 figures and a glossary of terms. New York: John Wiley and Sons. 1943. $3.75.

The authors, professor and head of the department of soils and associate professor of soils, respectively, at Michigan State College of Agriculture, East Lansing, Michigan, announce in the preface that the book was prepared for use as "a college textbook, a reference book for farmers and owners of farm lands, and as an aid to any one desiring information on soils and their culture."

Those who have made any attempt to teach soil science well realize the particular difficulties of subject-matter organization which the field of study represents. The task is not simplified by the need, in most university departments of agriculture, for serving not only students who are later to become specialists in soils but also those who are not soils majors but who should, nevertheless, have a fair general knowledge of soil science. When to the needs of these groups are added the demands of farmers and landowners, the preparation of a single, readable and satisfying book for all is a complicated undertaking.

The authors have dealt with the subject-matter in nineteen chapters throughout which photographs, figures and tables are fairly uniformly distributed. Many of the figures are new to text-books on soils and are valuable additions. Each chapter of the book contains lists of "Objectives" and "Questions" which are subject-matter headings, and should be of use to the beginning student. Chapters I to IX inclusive, and XV, which deal mainly with development, classification, physical and chemical properties, moisture, organisms, organic matter, soils and agriculture of arid regions, contain material which may properly be regarded as contributing primarily to knowledge of the fundamental properties of soils. These chapters cover about two thirds of the text. The remaining nine chapters are concerned with plant nutrition, fertilizers and fertility maintenance in soils, irrigation, soil in relation to fruit and lawn production and soil in relation to economics (productivity ratings of soils and soil resources): all subjects which, however valuable, are more closely connected with soil manangement, crop production and land evaluation than with fundamental soil science. In the earlier chapters there is also incorporated a considerable amount of material of an applied nature, *e.g.*, several sections on kinds of tillage implements, time and depth of tillage are included in the chapter on the physical and chemical properties of soils; a chapter on lime, with sections on the agricultural sources of lime, chemical guarantees and fineness, follows the chapters on chemical properties and soil reaction; the chapter on soil moisture includes sections on tile drainage, size of tile and so forth. This method of presentation undoubtedly adds to the interest of the subject, especially to the student with farm experience. The question nevertheless persists as to whether the method allows sufficient time at this stage in his training for the fullest development of the less easily acquired background necessary to the student majoring in soils, whose great opportunity is at hand to acquire the more difficult fundamentals.

The book is directly written, although at the cost of some oversimplification, for example, in parts of the chapter on soil moisture and elsewhere, and much has been accomplished in integrating the various subject-matter divisions and making the entire book interesting and readable. It is believed that attention might advisably have been given to the more complete development of some of the fundamentals and in acquainting the reader with the need for readiness, on his part, for repeated future adjustment of his point of view in order that he may be prepared to keep pace with advances in soil physics, soil chemistry and soil microbiology. It will appear to some that more conscious recognition might advantageously have been made, also, of the limitations of our present knowledge and, on that account, of the frequently arbitrary means which are devised for the solution of some of the most urgent soils problems.

An unfortunate error has been overlooked in the discussion accompanying the development of the expression for the pH of water in Chapter IV. The denominator term in the first equation on page 100 may be regarded as constant and almost equal to the molar concentration, per liter, of water. It is not infinite, but in either case it can not be ignored.

The book is a distinctly useful one and will be well received by students and farmers desiring an introduction to soil science.

G. B. Bodman

University of California,
Berkeley

TERMITES

Termites (Isoptera) from the Australian Region. By Gerald F. Hill. 479 pp. 24 plates. 353 figs. Australia: Council for Scientific and Industrial Research. 1942.

Those of us who take an interest in termites have followed the excellent work which Mr. Hill has done in Australia for many years past. In the book under review he has summarized the results of his investigation. The region is one which is particularly rich in species of termites. The Australian continent, alone, possesses no less than 140 species. As is well known, it possesses the only living species of *Mastotermes*, the most primitive living termite and one which is responsible for a large amount of economic loss. Mr. Hill gives the means of identifying all the termites, which he recognizes from Australia, New Guinea and the islands south of the Equator, between 140° E and 170° W, a region which is of very great interest to us in this country at the present time. Although the book is primarily a description of species in technical terms, it should not be forgotten that this is ultimately one of the major bases of our knowledge of any group of animals, and where an entire fauna is redescribed so far as possible by one man on a uniform basis, the value of all separate descriptions is enhanced.

The book, however, is more than that since it includes a summary of whatever is known, all too frequently very little, of the biology of the various forms. It may, therefore, be considered as a foundation upon which much future detailed work will be laid. It is not surprising, with such a rich fauna hitherto described in fragments by many investigators, that detailed experimental work on the physiology of the species has not been widely undertaken before. We may hope to see a great increase in such work in the near future, now that the solution of the always troublesome problems of identification of material has been rendered as simple as may be.

In spite of the fact that the book is lithoprinted, its appearance is very pleasing and the illustrations are excellently drawn and well reproduced. I noticed only a few typographical errors, of no particular consequence.

Charles H. Blake

SPECIAL ARTICLES

ON THE MECHANISM OF INSULIN ACTION: OBSERVATIONS WITH RADIOACTIVE PHOSPHORUS

In spite of the large amount of study that the subject has received, the mechanisms by which insulin brings about increased deposition of glycogen and oxidation of glucose in striated muscle are little better understood than when these effects were first observed. The participation of the phosphorus compounds in carbohydrate metabolism offers the hope that tracer studies with the radioactive isotope of this element (P^{32}) would cast some light on the matter. In this preliminary report are described some effects of insulin on phosphate metabolism in resting muscle, as determined by this technique; possible correlations of the findings on the intact animal with those obtained on cell-free extracts are discussed.

The injection of insulin into cats under pentobarbital anesthesia was found to result in an increased turnover rate of phosphocreatine P and of the two labile phosphate groups of adenosine triphosphate during glucose absorption, and no change in the rate of turnover of glucose-6-phosphate beyond that resulting from the administration of glucose alone.

Three groups of experiments were performed on 24-hour fasted animals. In each case, the muscles were analyzed 4 hours after the subcutaneous action of Na_2HPO_4 containing P^{32}. In the control group (8 animals) only the phosphate was given. A second group (4 animals) was given 50 ccm per kgm of 5 per cent. glucose solution intraperitoneally half an hour after the glucose. A third group (4 animals) was given glucose in the same way as the second group, followed half an hour later by a subcutaneous injection of 5 units of insulin per kgm.

The phosphorus compounds were separated from trichloroacetic acid filtrates and measurements of radioactivity made by methods similar to those previously described.[1] The data, given in Table 1, are expressed in terms of counts per minute per mgm of P, calculated to the basis of 10^6 counts per minute injected, per kgm body weight.

TABLE 1

Turnover Rates of Phosphorus Compounds in Resting Muscles of Cats, as Influenced by Glucose and Insulin*

	Inorganic phosphate	Phosphocreatine	Adenosine triphosphate	Glucose-6-phosphate	Plasma inorganic phosphate
Group I Phosphate only	364 (224–470)	125 (64–182)	82 (50–117)	208 (114–298)	9460 (5800–14.400)
Group II Phosphate and Glucose	308 (212–460)	115 (67–210)	77 (64–106)	522 (402–665)	9475 (7150–14,200)
Group III Phosphate, glucose and insulin	325 (225–415)	317 (205–425)	189 (133–248)	482 (374–620)	6200 (4950–8800)

* All values are expressed in terms of counts per minute per mgm P, calculated to the basis of 10^6 counts per minute injected, per kgm body weight. Figures given are averages, with the range in parentheses.

It is apparent that the injection of insulin during glucose absorption results in an acceleration of the turnover rates of phosphocreatine and adenosine triphosphate, and that this effect is not seen in the absence of an external supply of insulin. It is quite possible that this increased turnover is associated with the increased oxidation of glucose that insulin produces in resting muscle. Such coupling of phosphorylation with oxidative reactions has been reported many times in cell-free extracts. In most of such studies the emphasis has been placed on adenosine triphosphate, but the present findings indicate that phosphocreatine is also involved. Obviously it is inadvisable to attempt any specific correlations between the observed changes in the intact animal and the vast number of reactions found in cell-free extracts. However, these results point strongly in the direction of such an association of phosphorylation with glucose oxidation in the resting metabolism of muscle, and indicate that insulin, by accelerating glucose oxidation, also accelerates these phosphorylation reactions.

---

[1] Jacob Sacks and Charles H. Altshuler, *Am. Jour. Physiol.*, 137: 750, 1942.

With regard to glucose-6-phosphate, on the other hand, it is evident that the administration of glucose alone to the 24-hour fasted animal does produce an increased turnover which is not affected by an external supply of insulin. It remains for future study to determine whether the increased turnover evoked by glucose depends on the normal secretion of insulin.

Caution is necessary in evaluating the data on the glucose-6-phosphate in relation to the question of phosphorylation during glucose absorption. The presence of P^{32} in higher concentration in this substance than in the other organic phosphorus compounds shows that some phosphorylation of glucose does take place. However, in relation to the total probable glucose absorption, the amount of phosphorylation observed is rather small. This becomes evident on comparison of the P^{32} levels of glucose-6-phosphate and plasma inorganic phosphate. The average glucose-6-phosphate content of resting muscle does not exceed 10 mgm per cent., calculated as P, and there is no interchange of phosphate groups between this substance and phosphocreatine or adenosine triphosphate.[1] Therefore the transfer of 1 mgm per cent. of P across the cell membrane in the form of glucose-6-phosphate should raise the P^{32} level of this substance to at least 1,000 counts per minute per mgm P when the P^{32} of the plasma P is of the order of 10,000 counts per minute per mgm P. But the highest values obtained are only about half of this amount, indicating the transfer of about 3 mgm per cent. of glucose into the muscle in the form of glucose-6-phosphate. This holds even in the insulin experiments, when it would be anticipated that glycogen deposition and glucose oxidation are taking place at relatively high rates. If the glucose phosphate were dephosphorylated in the formation of glycogen, not only the glucose-6-phosphate but also the inorganic phosphate of the muscle should show higher P^{32} levels in the insulin experiments than in the other two groups. Two possible interpretations of the present data are: (1) that the absorption of glucose by the muscle fiber does not involve the entrance of a phosphate group into the cell, or (2) that glucose-6-phosphate is not involved in the principal mechanism of glucose absorption by resting muscle.

Summary. Insulin causes a marked increase in the turnover rates of phosphocreatine and adenosine triphosphate in resting muscle during glucose absorption, as determined with radioactive phosphorus, but does not cause any increase in turnover of glucose-6-phosphate beyond that produced by glucose itself.

The radioactive phosphorus used was supplied by the Department of Physics of the University of Michigan.

This work was supported by a grant from the John and Mary R. Markle Foundation.

JACOB SACKS

DEPARTMENT OF PHARMACOLOGY,
UNIVERSITY OF MICHIGAN MEDICAL SCHOOL

SULFONAMIDE DEPRESSION OF INORGANIC CATALYTIC ACTION[1]

AN anti-catalytic action has been urged as the fundamental mechanism of the antiseptic action of the sulfonamides, although it would probably be weaker than that of many other antiseptics. The evidence for this has been limited to catalysts in living microorganisms. This theory does not necessarily conflict with the competition-interference theory in which the utilization of para-aminobenzoic acid and other agents essential to bacterial growth is affected by sulfonamides, because metabolic functions are basically mediated by catalytic action. Depression of all catalysts by the sulfonamides would be expected to decrease metabolism and growth of microorganisms. Johnson[2] has reported that the activity of the catalyst luciferase is reduced by sulfonamides and a number of other chemically unrelated agents, which, however, possess in common a depressant pharmacological action, especially narcosis. Certain narcotics, alkaloids, antiseptics and toxic ions are known for their depressant actions on inorganic catalysts, which are wholly foreign to living microorganisms. Thus far, however, no test has been made for similar possible effects of the sulfonamides. If positive, this would help to establish a general anticatalytic action for these chemotherapeutic agents. This report presents positive results, demonstrated by us with three inorganic catalysts, namely, fullers' earth, platinum black and colloidal silver.

Methods: Santesson's[3] procedure for testing catalytic liberation of oxygen from hydrogen peroxide *in vitro* was used. Quinine and a number of other protoplasmic poisons known to inhibit this catalytic action were used for checking the validity of results with the sulfonamides and other compounds. In each experiment there were results on oxygen liberation with the unpoisoned catalyst, as control, for comparison with results with a number of agents under the same conditions. The procedure was as follows: Into a small fermentation tube a weighed and constant amount (20 mgm or less) of the catalyst was placed. Next, a small, though constant, amount of the agent to be tested was added, except in the controls (usually 1 cc of a 1 per cent. solution, or less). Then, 1 cc of a 1 per cent. solution of hydrogen peroxide was added. Finally, the tube was filled with water, and quickly inverted into a slightly larger tube, also filled with water. As the oxygen was liberated it collected in the smaller tube and the height of the column of gas was measured by comparison with a millimeter scale.

---

[1] From the Department of Pharmacology and Therapeutics, Stanford University School of Medicine, San Francisco, Calif.

[2] Johnson, SCIENCE, 95: 104, 1942.

[3] Santesson, *Skand. Arch. f. Physiol.*, 42: 129, 1922.

Three different catalysts were used, namely fullers' earth, which caused a slow liberation of oxygen; platinum black, which caused a rapid, almost explosive, liberation; and colloidal silver (collargol), which had intermediate activity. All gave similar results, but fullers' earth was used in the vast majority of experiments, as the slow action prevented loss of liberated oxygen during manipulation of the tubes. The action was somewhat capricious and necessitated use of accurate quantities throughout for satisfactory results. For each agent tested, multiple trials were made, usually 10 or more. There was a general tendency for the gas formation in both test and control tubes to reach eventually the same volume, and, therefore, the tubes were read at various times before the total completion of catalytic action. When platinum black and collargol were used, the gas-measurements were made at the end of 5 minutes, or less; with fullers' earth, at the end of 24 hours.

Comparative Effects of Various Protoplasmic Poisons and Sulfonamides: Quinine sulfate, quinacrine hydrochloride, pamaquine naphthoate (suspension), acriflavine, sodium salicylate, carbarsone and sodium cyanide markedly reduced the liberation of oxygen, generally less than 50 per cent. of the control volume. Free acids (sulfuric, ascorbic, nicotinic and para-aminobenzoic) were also strongly inhibitory, and therefore all agents with an acid reaction were carefully neutralized before trial. Alkalis (hydroxide and bicarbonate of sodium) had no effect, or increased slightly the liberation of oxygen. Accordingly, the effects of sodium salicylate and sodium cyanide, which are alkaline, must have been due to the salicyl and cyanogen ions, respectively. The single exception to the general group of protoplasmic poisons was sodium fluoride, which increased markedly the liberation of oxygen with fullers' earth and collargol. However, fluoride reduced the activity of platinum black, about like quinine. Platinum black and collargol were affected like fullers' earth by all other agents tried.

Sulfanilamide and sulfaguanidine were less active as depressants than the most potent poisons tried as they reduced the volume of liberated oxygen only about 16 per cent. The other sulfonamides tried, sulfapyridine, sulfathiazole, sulfadiazine, sulfacetimide and sulamyd, were more active, the liberation of oxygen being reduced from 22 to 54 per cent., despite their lower solubility than sulfanilamide. The sodium salts of acetylsulfanilamide and of acetylsulfapyridine were less effective, causing about 20 per cent. reduction in oxygen liberation. The sodium salts of sulfanilamide, sulfapyridine, sulfathiazole and sulfadiazine generally produced weaker effects than the free compounds, *i.e.*, about 20 per cent. less. The depressant effects of the sulfonamides occurred on all the three inorganic catalysts and were consistent in individual group tests, but varied from group to group, the per cent. changes reported being medians. It appeared interesting to determine next the effects of so-called "inhibitors" of sulfonamide action on the anticatalytic effects of these and some other drugs.

Action of "Inhibitors" on Anticatalysts: This was determined with fullers' earth only. Neutralized solutions of para-aminobenzoic acid alone had practically no demonstrable effect on oxygen liberation. When sulfonamides were also present, or quinine, pamaquine or quinacrine, there was no interference with their anticatalytic actions. Neutralized nicotinic acid had a strong depressant action on oxygen liberation, which was practically not affected by the presence of sulfonamides or the quinine group.

Comment: These results place the sulfonamides in the group of anticatalysts affecting non-living catalytic systems. This agrees with the claims of others as to an anticatalytic action in microorganisms being fundamental to the antiseptic action of these agents. The mechanism of this anticatalytic action is uncertain, but may be a physico-chemical surface phenomenon. Compared with the quinine group of alkaloids and a number of other protoplasmic agents, the sulfonamides are weak depressants of catalytic action, which is consistent with their known action as systemic antiseptics. Para-aminobenzoic acid, nicotinic acid and the sulfonamides are non-competitive for the inorganic catalysts used, as the nutrient agents do not demonstrably inhibit the sulfonamide depression. Nor does the latter involve replacement of the nutrient agents, since these are absent in the inorganic catalyst, unless purposely added. This lack of antagonism of the para-aminobenzoic acid and nicotinic acid on sulfonamides in inorganic catalysts is a difference from the conception of the antagonism or competition in living systems. However, this may be more apparent than real, as there are well-known difficulties in reconciling the actions of these agents and their properties and the relationships of antagonisms which need not be considered here. Certainly, it is of more than passing interest that the sulfonamides can reduce inorganic catalytic actions like other antiseptics and poisons.

CONCLUSIONS

(1) The sulfonamides decrease the liberation of oxygen from hydrogen peroxide by such inorganic catalysts as fullers' earth, platinum black and collargol, but the depression is much weaker than that caused by quinine, pamaquine, quinacrine and a number of other protoplasmic poisons. This agrees with current theories of an anticatalytic action as being fundamental to the antiseptic action of these agents.

(2) Para-aminobenzoic acid and nicotinic acid and the sulfonamides are non-competitive, or not antagonistic to each other, on the inorganic catalysts used, a difference from their action on microorganisms.

P. J. HANZLIK
W. C. CUTTING

GROWTH STIMULATION BY AMMONIUM SULFAMATE IN LOW CONCENTRATION

IN laboratory experiments on the toxicity of ammonium sulfamate $NH_4O_3SNH_2$ for nut grass (*Cyperus rotundus* L.),[1] it was observed that the poisonous action of the salt was preceded by a marked increase in the number of plants during the first three days of the experiment. Indications of a growth-stimulating action have been discussed also in investigations of other herbicides, *e.g.*, the chlorate,[2] the sodium bromate[3] and the thiocyanate.[4] The latter one has already found application for hastening the germination of seeds and potatoes.

It seemed worth while to investigate the possible stimulating effect of the ammonium sulfamate. Duckweed (*Lemna minor*) was selected as a test plant as in former experiments[3] because the increase in the number of plants offered a convenient way of watching the effect of the compound. The plants (on the average 20) were kept in glass jars filled with two inches of soil and two liters of tap water. The number of plants was counted daily and expressed in per cent. of the initial number. The curves reproduced below give the average of all the experiments performed during several months.

Curves 1 and 2 represent the effects of so much ammonium sulfamate as to make the solution 0.01 and 0.005 molar with respect to this salt (Fig. 1). In both cases the increase in number over the control experiments (curve 5) is very remarkable for the first 2 to 5 days, but then the poisonous action of the salt leads to a rapid and complete destruction of all the plants.

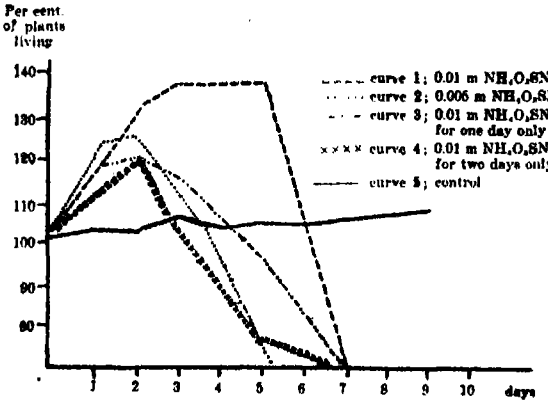


FIG. 1

It seemed possible that a reduction of the time of action of the salt on plants might lead to a separation of the stimulating and the toxic effect. In further experiments the plants were therefore removed from the sulfamate-containing jar after a limited period of time and transferred to another one containing tap water and soil only. Curves 3 and 4 show that an action of the sulfamate for two- or one-day, respectively, reduced mainly the stimulating effect but did not alter appreciably the rate of poisoning. However, the killing of the plants could be avoided when the contact with the sulfamate was limited to five hours (curve 6, Fig. 2). The increase in the number of plants was small under these circumstances, in fact only about one fourth of that obtained in the first experiment, but the rate of growth in the first two

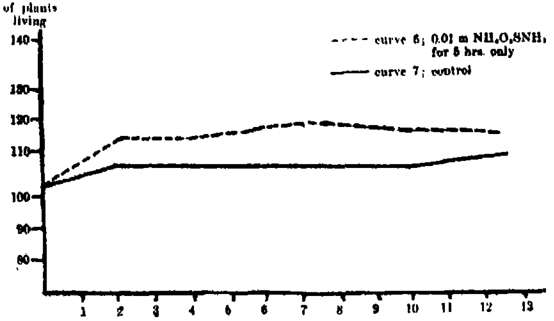


FIG. 2

---

[1] Fromm, *Ciencia y Técnica*, 1: 69, 1943.

[2] Shear, *Phytopathology*, 25: 440, 1935.

[3] Hessenland, Fromm and Saalmann, *Angew. Chem.*, 46: 577, 1933.

[4] Denny, *Biol. Abstracts*, No. 674, 1930.

days was twice that of the controls and thrice that of the controls for the first seven days, so that this stimulation appears to be well established.

There is not yet anything known as to the mechanism of this stimulation, but it seems of interest that the inorganic sulfamate causes here similar increases in growth as they were described recently by Lamanna[5] for low concentrations of sulfanilamide on bacteria.

F. Fromm

Polytechnic Institute
of Puerto Rico,
San Germán

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A COOL LIGHT FOR DISSECTING MICROSCOPES

Investigators who find the use of dissecting microscopes essential to their work are usually confronted with the problem of satisfactory illumination. After three years of extensive use, lights of the type described have proven superior to all others which we have tried.

The principle is simple and the parts are inexpensive. An automobile headlight bulb mounted in a small metal can (35 mm bulk load film can or a deep salve box) in which ventilating louvres have been cut serves as the source. This may be mounted on any convenient stand or on the microscope itself. Power is furnished by a transformer which delivers six volts and will carry up to two and one-half amperes of current. If intensity control is desired, a rheostat may be inserted in series with the primary coil of the transformer (in the input—110 volt—line). The important feature of the light is the lens system. It is composed of a rod of methyl methacrylate polymer (du Pont Lucite) ⅝″ by 3″ or larger upon the ends of which a lens combination has been ground. The rod is mounted in the lamp housing so that the filament of the light is centered and thus serves to focus the source and at the same time to filter out nearly all the heat. Small pieces of Lucite may be obtained in the form of utility lights from drug and department stores or in rods from the manufacturer.

In order to concentrate the source of light upon the object, a bi-convex lens system can be ground upon the two ends of the rod. Grinding a curved surface is in reality easier than a plane surface and can be done by clamping the rod at the desired radius of curvature in a flexible support and working the surface into a curve by moving the end in an irregular manner over a plane surface covered with a fine abrasive. Final polishing should be done with rouge or Tripoli powder. The lens can be ground and polished in about thirty minutes. The radii of curvature may be calculated from the common formula for a thick lens which can be obtained from handbooks of physics and chemistry. Details of the assembly are apparent in Fig. 1.

For work on living material or material immersed in a saline solution, water or a solvent this light has proved most satisfactory since very little heat is transmitted to the object. Physiological processes are not upset, salines and solvents are not evaporated rapidly, and an intense spot of light is directed to the object. When water or saline solutions are used to cover the object, undesirable surface reflections can be avoided by immersing the end of the rod. These features are unique with this light.

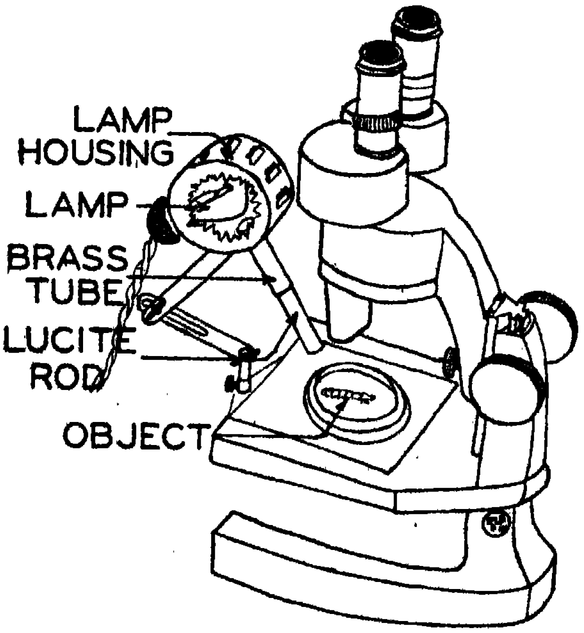


Fig. 1

Robert L. Patton

Laboratory of Insect Physiology,
Department of Entomology,
Cornell University

---

[5] Lamanna, Science, 95: 304, 1942.

BOOKS RECEIVED

Black, John D. *Food Enough.* Illustrated. Pp. vii + 269. Jaques Cattell Press. $2.50.

Courant, R. and D. Hilbert. *Methoden Der Mathematischen Physik.* 2 Volumes. Pp. xxviii + 1018. Interscience Publishers. Set, $14.00. Each volume, $8.00.

Greenwood, Major. *Authority in Medicine: Old and New.* The Linacre Lecture, 1943. Pp. 31. Cambridge University Press and Macmillan Co.

Binde, Charles A. *Electricity and Its Application to Civilian and Military Life.* Illustrated. Pp. xii + 466. Harcourt, Brace and Company. $2.50.

Shapley, Harlow, Samuel Rapport and Helen Wright. *A Treasury of Science.* Pp. xi + 716. Harper and Brothers. $3.95.

SCIENCE

Vol. 98 Friday, November 5, 1943 No. 2549

Man's Most Creative Years: Then and Now: Professor Harvey C. Lehman ... 393

Obituary:
William Fogg Osgood: Professors Julian L. Coolidge, George D. Birkhoff and Edwin C. Kemble. *Deaths and Memorials* ... 399

Scientific Events:
The Fortieth Anniversary of the Flight of a Heavier-Than-Air Machine; Preference Ratings for Laboratory Equipment; A Survey of Medical Colleges; Personnel Problems in Geology; Tercentenary Commemoration of the Invention of the Barometer, 1643–1943; American-Soviet Conference; The Tenth Anniversary of the Planetarium and Museum of the Franklin Institute ... 400

Scientific Notes and News ... 404

Discussion:
The Botanical Name of the Giant Sequoia: Dr. G. Neville Jones. *Apparent Time Acceleration with Age:* Professor A. J. Carlson, Dr. Cyril E. Abbott and R. P. Harriss ... 406

Scientific Books:
Legendre Associated Functions: Professor R. C. Archibald. *Man and His Physical Universe:* Professor S. A. Korff ... 409

Special Articles:
Perfusion of Rat Livers with Estrogen in Vitro: Joseph Schiller and Professor Gregory Pincus. *Inability to Pass Primary Atypical Pneumonia to Human Volunteers:* Commander Deane H. Vance, Lieutenant Thornton Scott and Professor Herman C. Mason ... 410

Scientific Apparatus and Laboratory Methods:
Sterility Test for Penicillin: Dr. C. A. Lawrence. *Quieting Paramecium for the Elementary Student:* Dr. Douglas A. Marsland ... 413

Science News ... 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell; Ware Cattell, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

MAN'S MOST CREATIVE YEARS: THEN AND NOW

By Professor HARVEY C. LEHMAN

OHIO UNIVERSITY

In previous articles the present writer has presented age-curves which set forth the chronological ages at which world-famous geniuses have either achieved or first published their best work.[1] The present study is an attempt to discover whether or not the age-curves thus far obtained are destined to hold for future as well as for past centuries. Although one can not be entirely certain as to what will happen in the centuries that lie ahead, it seems quite possible that a review of what has occurred in the past may provide one with a preview of what is likely to occur in the immediate future.

As a means of investigating the age-changes that may already have taken place the writer has partitioned some of his data upon the basis of the periods during which the various types of creative thinkers were born. In partitioning the data thus it was assumed that, if any change has already occurred in the chronological ages at which eminent thinkers have accomplished the various things which enabled them to attain recognition, this change would perhaps be revealed by study of the partitioned data.

For example, W. F. Magie's "A Source Book in Physics"[2] sets forth the chronological ages at which 140 notable contributions to the science of physics were either made or first published by 89 deceased individuals. In Fig. 1 the broken line sets forth the average number of contributions per ten-year interval for approximately the 50 per cent. that were earliest born, and the solid line sets forth similar information for the 50 per cent. that were most recently born. In both of these age-curves the average number of contributions per ten-year interval was plotted in order to make proper allowance for the larger number of youthful research workers.

---

[1] H. C. Lehman and W. S. Gamertsfelder, *Psychological Review*, 1942, 49; 319–344. (A bibliography of 9 articles of this series is to be found on page 343. In this list the 11th reference should be to the *Psychological Review* instead of to the *Psychological Bulletin*.

[2] W. F. Magie, "A Source Book in Physics." New York: McGraw-Hill Book Co., Inc., 1935. Pp. xiv–620.

If, regardless of the number of workers that remained alive, the older age groups had contributed at the same average rate as did the younger age groups, both of the curves of Fig. 1 would remain as high at the older as at the younger age levels. Actually, both curves of Fig. 1 exhibit very noticeable and consistent decrements at the uppermost age levels, thus indicating that both groups of physicists became progressively less productive at the older age levels. Obviously, the foregoing statements hold only for creative work of the highest order; it may or it may not hold true for quantity of output.

Fig. 1 reveals that, as compared with the age-curve which sets forth data for the earlier-born group of physicists (the broken line), the curve for the more recently born group (the solid line) has the following characteristics: (1) It starts its ascent at the same age-interval, namely, at ages 20–29, inc.; (2) it rises more rapidly and it attains its peak ten years earlier, *viz.*, at ages 30–39 instead of at ages 40–49, and (3) it falls off at about the same rate of speed but, since the solid line starts its descent ten years earlier, the solid line is from 10 to 15 per cent. lower than the broken line at each age level from ages 45 to 65, inclusive.

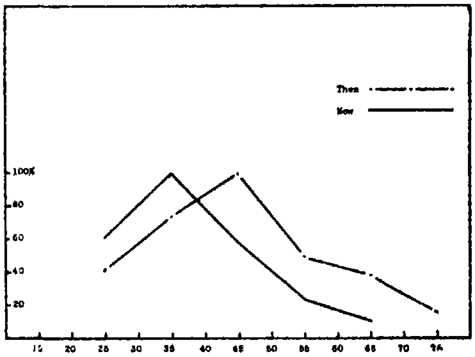


FIG. 1. Man's most creative years in physics: then and now. (Then) 60 contributions by 45 physicists born prior to 1785. (Now) 80 contributions by 44 physicists born from 1785 to 1867 inc. Data from Magie, W. F., "A Source Book in Physics." 1935.

Fig. 1 thus reveals that, as a group, the more recently born contributors to the science of physics have been somewhat younger at the time of making their world-famous contributions than were the earlier-born contributors. Somewhat similar findings have been obtained for the more recently born sub-groups of individuals who have contributed to the fields of geology, mathematics, invention, botany, pathology, classical descriptions of disease, medicine and public hygiene, literature, economics and political science, education and philosophy.[3] Since the findings for each of these sub-groups are presented herein in graphic form, they will require little comment. The general procedure for constructing the several age-curves has been similar for each type of eminent thinker. That is to say, for each of the sub-groups of contributors to a given field, an age-curve was drawn setting forth the average number of contributions per ten-year interval.[4] In each of these fields of endeavor it has been possible, therefore, to compare the output of approximately the earlier-born 50 per cent. with the output of the 50 per cent. that were more recently born.

Fig. 2 sets forth data for geologists, and Figs. 3 to 8, inclusive, set forth analogous information for mathematicians, inventors, botanists, pathologists, classical describers of disease and contributors to medicine and public hygiene. For each of these types of creative thinkers the source from which data were obtained is given in the bibliography.[5-11] In general,

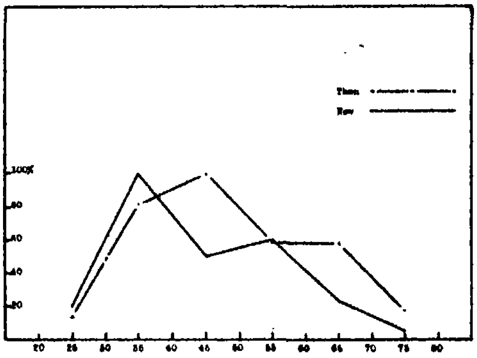


FIG. 2. Man's most creative years in geology: then and now. (Then) 84 contributions by 63 geologists born prior to 1800. (Now) 99 contributions by 65 geologists born from 1801 to 1857 inc. Data from Mather, K. F., and Mason, S. L., "A Source Book in Geology." 1939.

---

[3] In three fields of endeavor, namely, in chemistry, in astronomy and in oil painting, no significant age-change is discernible.

[4] Units of ten-year intervals will be used for the following age-curves unless otherwise specified. In constructing the graphs that accompany this article, the data for each of them were first reduced to a comparable basis by the following procedure: The peak of each statistical distribution was arbitrarily assigned a value of 100 per cent. and the other averages within the same statistical distribution were then assigned proportionate percentage values. For example, in Fig. 1, the peak of the distribution that is pictured by the solid line occurred at ages 30–39 inclusive. This modal value was taken to be 100 per cent. and the remaining frequencies by age-group were then computed and plotted as percentages of this modal value.

[5] K. F. Mather and S. L. Mason, "A Source Book in Geology." New York: McGraw-Hill Book Co., Inc., 1939. Pp. xxii–702.

[6] David Eugene Smith, "A Source Book in Mathematics." New York: McGraw-Hill Book Co., Inc., 1929. Pp. xvii–701.

these age-curves reveal that one or more of the comments already made with reference to Fig. 1 hold also for Figs. 3 to 8, inclusive.

Fig. 4 (inventions) is based upon data obtained from such well-known sources as "The Lincoln Library of Essential Information,"[7a] the "Standard Dictionary of Facts,"[7b] "The Scientific American Reference Book,"[7c] and so forth. Although in Fig. 4 the peaks of both age-curves occur at ages 30–39, it will be noted, nevertheless, that the curve for the more recently-born group (the solid line) rises more rapidly and it also falls off more rapidly than does the curve for the earlier-born individuals.

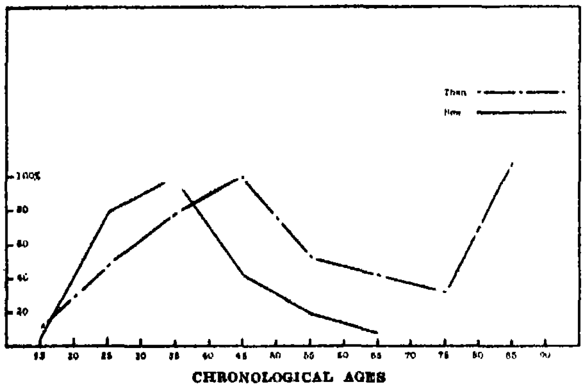


FIG. 3. Man's most creative years in mathematics: then and now. (Then) 54 contributions by 28 mathematicians born prior to 1748. (Now) 42 contributions by 27 mathematicians born from 1748 to 1848 inc. Data from Smith, D. E., "A Source Book in Mathematics." 1929.

In Fig. 6 (pathology) the peaks of both curves likewise occur at ages 30–39, inclusive, and here too the curve for the more recently born group (the solid line) starts at a higher level and it also descends more rapidly than does the curve for the earlier-born. Fig. 6 thus suggests that, as compared with the more recently born group, the earlier-born group of pathologists were slower in starting to contribute and that they contributed more at the older age levels. It is, of course, possible that no genuine age-change has occurred as regards the average productivity of the several age groups but that only the time-lag between the date of discovery and the date of announcing the discovery has been decreasing during the past few centuries. Certainly, a large decrease in the amount of time-lag

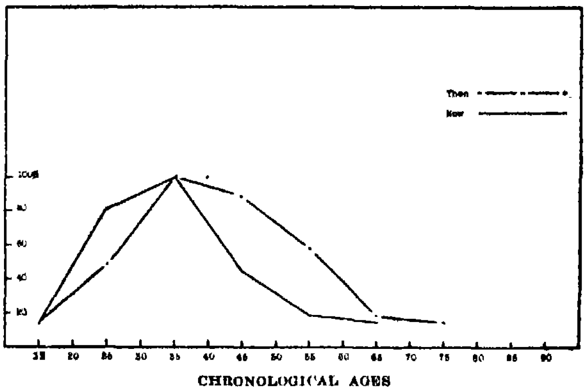


FIG. 4. Man's most inventive years: then and now. (Then) 154 inventions by 86 inventors born prior to 1750. (Now) 135 inventions by 86 inventors born from 1830 to 1850 inc. Data from various sources. See text.

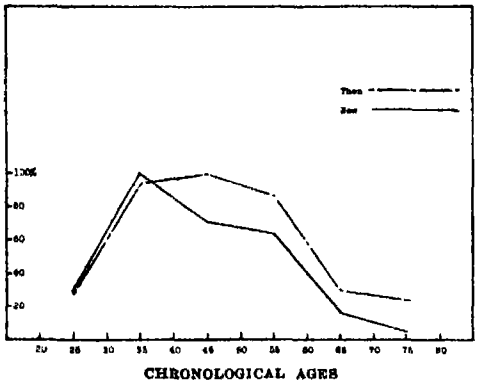


FIG. 5. Man's most creative years in botany: then and now. (Then) 91 contributions* by 53 botanists born prior to 1800. (Now) 144 contributions* by 50 botanists born from 1800 to 1854 inc. Data from Reed, H. A., "A Short History of the Plant Sciences." 1942.

* For the botanists it was not possible for the present writer to ascertain the exact number of different contributions. It was possible only to tabulate each time a dated contribution was mentioned in Reed's history. The same contribution may therefore have been counted more than once. The computations that were employed for constructing Figure 5 are based upon the foregoing procedure.

---

[7] (a) "The Lincoln Library of Essential Information." Buffalo, New York: The Frontier Press Co., 1934. (Modern inventions are listed on pp. 1336 *ff.*) (b) H. W. Ruoff (editor), "The Standard Dictionary of Facts." Buffalo, New York: The Frontier Press Co., 1910. (c) "The Scientific American Reference Book." Compiled by A. A. Hopkins and A. R. Bond. Munn and Co., publishers. Scientific American Offices. New York: 1905. Pp. viii-516. (See especially pp. 218–224 and pp. 216–*ff.*) (d) E. E. Irvine (editor), "The World Almanac and Book of Facts for 1938." New York: Published annually by *The New York World Telegram.* 1938. Pp. 64–960.

[8] H. S. Reed, "A Short History of the Plant Sciences." Waltham, Mass.: Published by the Chronica Botanica Company. 1942. Pp. x–320.

[9] E. B. Krumbhaar, (editor), "Clio Medico: A Series of Primers on the History of Medicine." XIX. Pathology by E. B. Krumbhaar, New York: Paul B. Hoeber, Inc., Medical Book Department of Harper and Brothers. 1937. Pp. xvii–206. (See pp. 157 *ff.*)

[10] Ralph Major, "Classical Descriptions of Disease." Springfield, Illinois: Thomas. 1932. Pp. xxvii–630.

[11] F. H. Garrison, "An Introduction to the History of Medicine." Fourth edition. Philadelphia and London: W. B. Saunders Co., 1929. Pp. 996. (A chronology of medicine and public hygiene is given on pp. 809 *ff.*)

between date of discovery and the date of announcement thereof could account for much or even all of the apparent age-change that has been found in the present study.

Figs. 9 to 13, inclusive, are based upon composite lists of contributions. The procedure that was employed for obtaining each of these composite lists will be illustrated by describing the manner in which the data for the philosophical contributions were obtained. The most important philosophers were identified by canvassing more than 50 standard histories of philosophy. The foregoing procedure assumes: (1) That no single authority is an absolutely safe guide; (2) that by careful collation of a large number of authoritative lists one can sift out the questionable names and be sure that no very important names have been overlooked, and (3) that the collective judgment of these

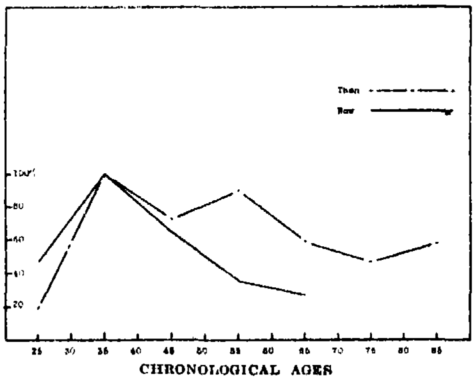


FIG. 6. Man's most creative years in pathology: then and now. (Then) 110 contributions by 88 pathologists born prior to 1773. (Now) 107 contributions by 84 pathologists born from 1773 to 1871 inc. Data from Krumbhaar, E. B., (editor). Clio Medica: "A Series of Primers on the History of Medicine." 1937.

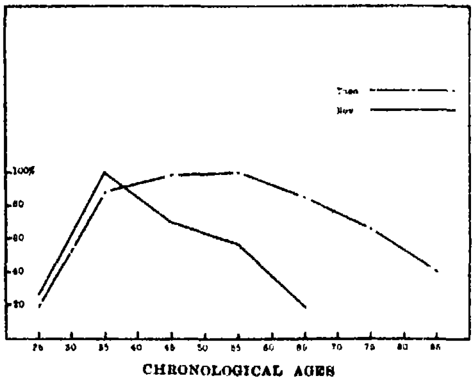


FIG. 7. Classical descriptions of disease: then and now. (Then) 67 classical descriptions of disease by 51 individuals born prior to 1759. (Now) 77 descriptions by 52 individuals born from 1760 to 1850 inc. Data from Major, R. H., "Classical Descriptions of Disease," 1932.

professional historians is likely to be more valid than are the individual judgments when taken singly. It would seem to be a self-evident fact that a philosopher whose writings are mentioned and discussed in many of the standard histories of philosophy is likely to be more important as a philosopher than is another individual whose philosophical writings are cited and discussed in only a few histories of philosophy.[12]

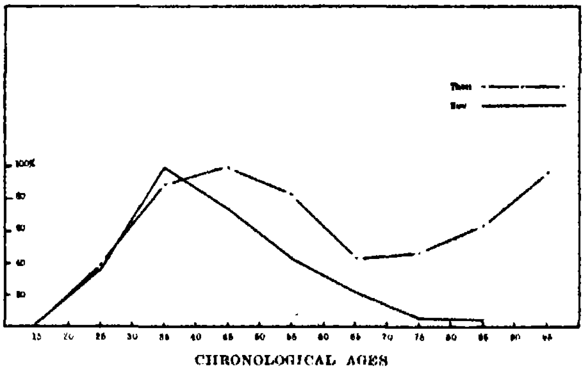


FIG. 8. Man's most creative years in medicine and public hygiene: then and now. (Then) 321 contributions by 215 contributors born prior to 1749. (Now) 407 contributions by 275 individuals born from 1750 to 1850 inc. Data from Garrison, F. H., "An Introduction to the History of Medicine." 1929.

In constructing Fig. 9 (philosophy) the writer has thus used the collective judgments of historians who have published their evaluations under their own signatures and who must, therefore, have tried conscientiously to cite and to discuss only the more impor-

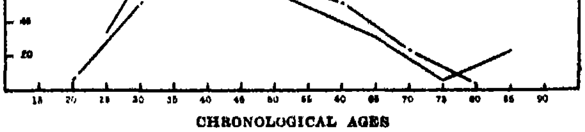


FIG. 9. Man's most creative years in philosophy: then and now. (Then) The one most significant work by each of 97 philosophers born prior to 1763. (Now) The one most significant treatise by each of 97 other philosophers born from 1764 to 1850 inc. Data from a composite list. See text.

---

[12] The names of 30 outstanding philosophers from various countries of the world are to be found in the *Psychological Review*, 1942, 49: p. 320, Table I. Important philosophical writings are listed on p. 322, Table II.

tant philosophical treatises. It also seems probable: (1) That this large number of independent critics did not concern themselves with the age factor; (2) that whether they were or whether they were not aware of the age factor, they probably have exhibited no constant prejudice for or against any one particular age group, and (3) that careful tabulation of the number of different histories in which a given philosophical treatise was cited and discussed should enable one to identify the really great philosophical works.

For each philosopher who wrote at least one book which appeared in as many as 5 different histories of philosophy, the philosopher's one most important treatise was ascertained. In selecting each philosopher's one most important writing it was assumed that the one treatise by a given philosopher which was cited and discussed in the largest number of standard histories was that particular philosopher's most important work. In this manner the 194 most important or significant works by each of 194 deceased major philosophers were identified. Fig. 9 reveals, both for the earlier-born 50 per cent. and for the more recently born 50 per cent., the average number of most important philosophical works that were either written or first published[13] during each ten-year interval of the authors' lives.

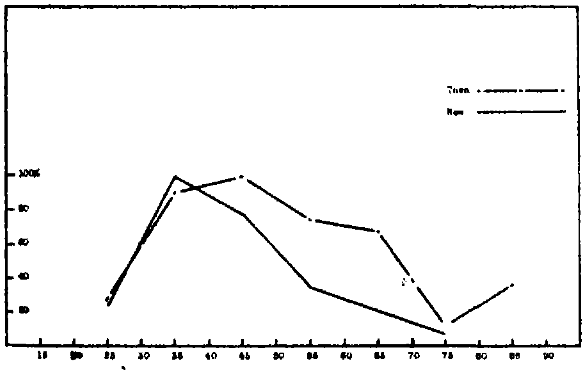


Fig. 10. Man's most creative years in literature: then and now. (Then) The one "best book" by each of 96 world-famous authors born prior to 1807. (Now) The one "best book" by each of 94 other world-famous authors born from 1807 to 1851 inc. Data from Dickinson, A. D., "One Thousand Best Books" 1925.

In the construction of Fig. 9 (philosophy), for the earlier-born group, the age intervals differ slightly from the age intervals that were employed in drawing Figs. 1 to 8 inclusive. In Figs. 1 to 8 inclusive, age intervals 20–29, 30–39 and so forth were employed. But, in constructing the broken line of Fig. 9, age intervals 15–24, 25–34 and so forth have been used. These latter age intervals were employed in constructing the broken line of Fig. 9 because it was found by trial-and-error that this method of plotting brings out more clearly the trend of the age changes that seem to have occurred as regards philosophical contributions.

Fig. 10 presents information regarding the chronological ages at which 190 notable authors either wrote or first published so-called "best books." The best books were identified in 1924 by Mr. Asa Don Dickinson, librarian of the University of Pennsylvania, who made a composite study of more than 50 "best book" lists. From Dickinson's[14] composite list the present writer identified the one "best book" by each[15] of 96 authors born prior to 1807, and also the one "best book" by each of 94 other authors who were born from 1807 to 1851 inc. In the construction of Fig. 10, no author's book was used unless the author had written at least one book which appeared as many as 5 times in Dickinson's composite list. Since most of the authors whose best books were employed in the construction of Fig. 10 wrote books which appeared more (some of them many more) than 5 times in the Dickinson composite list, it should be apparent that the foregoing minimum requirement for inclusion in Fig. 10 makes for a very severe selection. Indeed, for each kind of endeavor that is discussed herein, the criterion of selection is so high that the present study includes, with a few possible exceptions, only the *most* distinguished, who contributed within a given field, of whom there is historical record, and it includes (for each field studied) substantially all these.

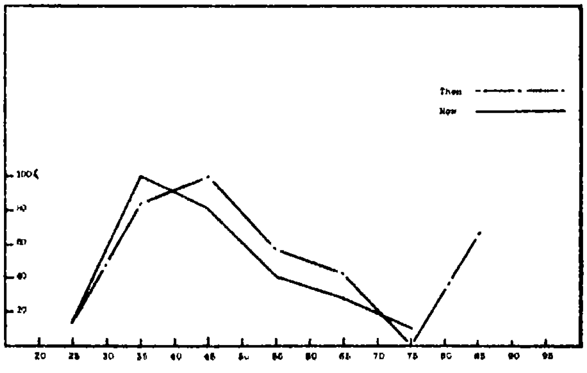


Fig. 11. Man's most creative years in education: then and now. (Then) The one most important treatise by each of 63 educational theorists born prior to 1743. (Now) The one most important writing by each of 60 other educational theorists born from 1744 to 1849 inc. Data from a composite list. See text.

---

[13] The dates of composition were employed whenever they were available. When dates of composition could not be obtained, the dates of first publication were used.

[14] A. D. Dickinson, "One Thousand Best Books," p. xii. Garden City: Doubleday, Page and Co., 1925. Pp. xvii–416.

[15] All authors for whom dates of birth and death and dates either of writing or of first publication were available.

Fig. 11 is based upon data obtained from 49 histories of education. The two curves of Fig. 11 reveal the ages at which the one most important book, report or educational plan was advanced or first published by each of 123 individuals, all of whom are well known in the history of education. No book, report or educational plan was employed in the construction of Fig. 11 unless it appeared in as many as 3 of the 49 histories of education. This was the minimum requirement for inclusion in Fig. 11. Obviously, most of the educational theorists whose works are included in Fig. 11 could have passed a much higher criterion of selection.[16]

Figs. 12 and 13 (economics and political science) are based similarly upon study of 20 books which deal with the history of those two subjects. Fig. 12 sets forth data regarding the one most important treatise by each of 142 individuals who wrote at least one book which appeared in as many as 4 of the 20 histories of economics and political science,[17] and Fig. 13 presents analogous information regarding 255 other individuals who wrote books which were cited and discussed in from 1 to 3 of the histories, *e.g.*, who wrote no book which appeared in as many as 4 of the 20 histories of economics and political science. Fig. 12 thus reveals the most creative years for each of two groups of major economists and political scientists and Fig. 13 sets forth comparable information for each of two groups of minor economists and political scientists. It seems apparent that for both the major and for the minor economists and political scientists the peaks of productivity were attained ten years earlier by the sub-groups that were more recently born.

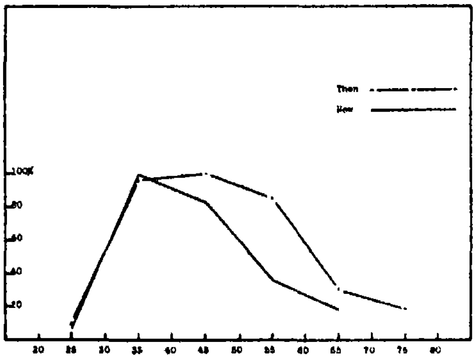


Fig. 12. Man's most creative years in economics and political science: then and now. (Then) The one most important treatise by each of 73 major contributors born prior to 1790. (Now) The one most important treatise by each of 69 major contributors born from 1791 to 1850 inc. Data from a composite list. See text.

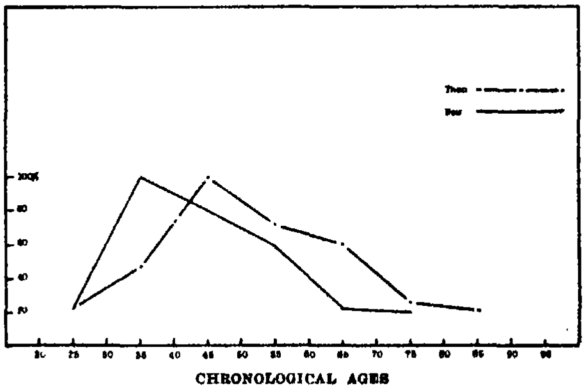


Fig. 13. Man's most creative years in economics and political science: then and now. (Then) The one most important treatise by each of 129 minor contributors born prior to 1790. (Now) The one most important treatise by each of 126 minor contributors born from 1790 to 1851 inc. Data from a composite list. See text.

Concluding Remarks

For 12 of the fifteen types of creative endeavor that have been mentioned in the present article, the contributions of the more recent era were made at younger age levels. For three of them, namely, chemistry, astronomy and oil painting, no significant age-change is evident. Just why 80 per cent. of the age-curves which reveal brilliant intellectual attainment should start their descents at earlier age levels for the more recently born individuals the present writer does not know. The following conjectures may account in part for the earlier peaks in the age-curves of the more recently born groups. However, they do not account for the more rapid descent of the age-curves of these sub-groups after the curves have attained their peaks.

(1) Chance factors have probably become less operative with the passage of time. (2) The early amateur investigators were more often self-educated; they had less opportunity to receive formal instruction and to experience the stimulation that is provided by groups of understanding colleagues. (3) The early workers possessed fewer ready-made tools or tech-

---

[16] The following is a list of the seven most outstanding educational treatises, giving the author, the book or treatise and the number of histories of education discussing it. J. J. Rousseau, "Emile," 40; J. A. Comenius, "Great Didactic," 38; John Locke, "Some Thoughts Concerning Education," 35; John Milton, "Tractate on Education," 35; Roger Ascham, "The Schoolmaster," 31; F. Froebel, "The Education of Man," 30; J. H. Pestalozzi, "Leonard and Gertrude," 30.

[17] The six most frequently discussed works in economics and political science, by author, book or treatise and number of histories of economics and political science discussing it follow. Adam Smith, "Wealth of Nations," 16; F. List, "Das Nationale System der Politischen Oekonomie," 14; T. R. Malthus, "Essay on Population," 14; David Ricardo, "On the Principles of Political Economy and Taxation," 14; Karl Marx, "Das Kapital," 13; J. S. Mill, "Principles of Political Economy," 13. Further research would no doubt change the relative amount of credit that is assigned to specific works. This change would probably not alter the shapes of the age-curves appreciably.

niques. These research devices had not yet been invented or discovered. (4) During the last few centuries, avenues of publication have increased very greatly in number. Moreover, both the demand and the reward for creative thinking have been growing. (5) According to Florian Cajori,[18] prior to about the beginning of the eighteenth century, mathematicians often deliberately withheld their discoveries as a means of preserving and enhancing their prestige (see Fig. 3). (6) The time-lag between date of discovery and the date of publication thereof may have been decreasing during the past few centuries.

Although the foregoing speculations may account in part for the finding that the contributions of the more recent era tend to occur at younger age levels, these speculations are rather inadequate. Perhaps it will be just as well if we confess our ignorance and ask not why this change has occurred but rather confine our attention to what has happened. At this point the present writer finds himself in hearty agreement with Professor Harvey B. Lemon, who, with reference to certain researches in the field of physics, has written:

> Our investigations into these things have but begun. What we do not ourselves understand any too well we cannot, naturally, explain fully to others.[19]

It has been suggested to the present writer that, whereas, in former days significant scientific contributions could be made often by youthful investigators who possessed relatively meager knowledge and background, to-day it may perhaps be necessary for the potential contributor to possess more extensive experience and a much larger fund of knowledge if he is to display effective and profound originality. It has also been argued that, because of our present greater average length of life, as compared with the average of previous centuries, maximum intellectual fecundity in the future will also tend to occur at older age levels.

The foregoing data reveal no factual basis for supposing that the most important creative work of the present day is being done by individuals who are older than the contributors of past centuries have been. Indeed, if any genuine age-change has been occurring (something more than a mere decrease in time-lag), the change seems to favor the younger rather than the older age-groups. And if a review of what has taken place in the past is an indication of what is likely to occur in the immediate future, it seems clear that there is no evidence whatever to support the hypothesis that future generations of creative thinkers will attain their peak output at increasingly older age levels. However, as was stated previously, this generalization does not hold for quantity of output but only for creative work of the highest merit.

OBITUARY

WILLIAM FOGG OSGOOD

William Fogg Osgood was born in Boston on March 10, 1864, son of William and Mary (Gannett) Osgood. In July, 1890, he married Therese Ruprecht, by whom he had two sons and a daughter. In August, 1932, he married Céleste Phelps Morse, who survives him. He died on July 22, 1943.

Osgood was prepared for college at the Boston Latin School and became a member of the class of 1886. He took second-year honors in classics, and final highest honors in mathematics. There was little in the Harvard curriculum at that time to inspire a young man to give his life to mathematical research. The only member of the Mathematics Department, actively interested in scientific advance, was the youthful Benjamin Osgood Peirce, and his interest lay largely in the field of physics. But Osgood had early absorbed the idea that mathematics was the most difficult subject to be studied, and he meant to try for the biggest prize.

On graduation from Harvard he spent one more year in Cambridge as a graduate student, then went abroad for three years of advanced study in Germany. He spent the first two years in Göttingen, working especially under that prince of teachers, Felix Klein. His third year was in Erlangen, and there he took his doctorate. The years spent in Germany determined absolutely his whole future life. He married a German wife. He acquired such a mastery of German that his most important scientific writings were in that language. He adopted the German Weltanschauung to an extent that became somewhat embarrassing during the first World War. In the present crisis he saw matters in a different light. He received a mathematical impulse which guided his scientific thinking for the rest of his life.

Osgood returned to Harvard to teach in the autumn of 1890, thus beginning a connection which remained unbroken until the time of his retirement at the age of 69, in 1933. His was a distinguished and successful career. He saw the need for real improvement in the Harvard mathematical teaching. Byerly was an outstanding teacher in introductory courses, and J. M. Peirce was patient and conscientious, but there were others in the teaching force who lacked both didactic skill and scientific interest. Osgood undertook to improve this situation. His teaching, whether of freshmen or graduates, was careful, clear and conscientious. He introduced a standard of rigor in Harvard mathematics which had been quite absent before. Many students received from him standards of absolute exactness and scientific honesty which lasted them through life. He wrote four text-books which were admirable for clearness and care. He never forgot the importance of linking up mathematics with physics. It is fair to say that to him this meant the application of classical mathematics to classical physical questions, rather than adapting new mathematical techniques to new physical demands.

---

[18] F. Cajori, "A History of Mathematics," p. 133. Second edition. New York: The Macmillan Co., 1922. Pp. xiv–516.

[19] H. B. Lemon, "From Galileo to Cosmic Rays," p. 334. Chicago: The University of Chicago Press. 1934. Pp. xviii–450.

Osgood pursued a life of scientific activity without haste and without rest. After his retirement from Harvard he spent two interesting years at the National University in Peiping, publishing two books, in English, which supplemented some of his earlier work.

He had returned from Germany at a critical moment when a number of young Americans, with training and ideals like his own, were determined to raise American mathematics to the standard of the subject in Europe. This was done partly by individual contributions, partly by founding and fostering the American Mathematical Society. Osgood was the eighth president. The essential quality of his own mathematical contributions, some seventy in number, was soundness. Whatever he wrote was rigorous and significant. He had a clear idea of what he believed to be of permanent importance in mathematical science, and that alone claimed his interest. He had no interest in the flashy or trivial. He was suspicious of devices which seemed too ingenious, fearing hidden difficulties. When a young man of thirty-two, he was invited to contribute one of the most important articles to the universal mathematical bible, the *Encyklopädie der mathematischen Wissenschaften*. His *Lehrbuch der Funktionentheorie*, which ran into no less than five editions, is the classical treatise on this fundamental subject. There was perhaps little change either in his scientific thinking or technique during the course of his career. In Germany he had such a large vision of the sort of work he would like to do, that its accomplishment and natural extensions sufficed for the whole of his productive life.

Osgood had two compelling loyalties, to mathematical science and to Harvard University. Utterly lacking in personal ambition, he had the highest hopes for the Harvard mathematical school. He took little share in the wider parts of university administration, but was characteristically conscientious in performing specific tasks, however monotonous. He was unwearied in his acts of kindness to individual students, and he treated all with an old-fashioned courtesy which sprang from his deep love for his fellow man.

JULIAN L. COOLIDGE
GEORGE D. BIRKHOFF
EDWIN C. KEMBLE

DEATHS AND MEMORIALS

DR. WILMON NEWELL died on October 26. Since 1915 he had been provost for agriculture at the University of Florida and a leader in the agricultural development of the state. He was appointed in 1920 dean of the College of Agriculture and director of the Experiment Station and the Agricultural Extension Service.

DR. THOMAS ANDREW STOREY, formerly director of the School of Hygiene at Stanford University, died on October 27 at the age of sixty-eight years.

PAUL BLAKESLEE MANN, who retired in 1941 as supervisor of science in the senior high schools of the New York City public school system after a career of forty years in teaching, died on October 22 at the age of sixty-six years.

DR. ELLIOTT SMITH, director of the Observatory of the University of Cincinnati, died by suicide on September 29. He was sixty-eight years old.

DR. WILLIAM WALDO BLACKMAN, professor emeritus of anatomy at the Flower and Fifth Avenue Hospitals of the New York Medical College, died on October 20 at the age of eighty-seven years.

THE Senate adopted on October 21 a resolution designating February 11, 1944, as Thomas Alva Edison Day. Under the resolution, which must have House approval, the President would be requested to issue a proclamation directing display of the flag on all Government buildings and inviting appropriate ceremonies in schools and churches or other suitable places.

SCIENTIFIC EVENTS

THE FORTIETH ANNIVERSARY OF THE FLIGHT OF A HEAVIER-THAN-AIR MACHINE

GOVERNOR J. MELVILLE BROUGHTON, of North Carolina, has issued the following proclamation:

> Forty years ago, amidst the sand dunes at Kitty Hawk, North Carolina, two brothers, then obscure but since made famous, began experiments for the purpose of testing and confirming their conviction that machines heavier than air could be made to fly. In this seemingly fantastic endeavor, which was met with scepticism and even ridicule, they devoted many long hours and days of effort, experiment and frustration. Ultimately their efforts were crowned with success, and on December 17, 1903, the world was electrified at the announcement that for the

first time in history a heavier-than-air machine had on that day been successfully flown at Kitty Hawk. Thus the airplane was born. Its creators were the immortal Wright brothers, Wilbur and Orville: and its place of birth was Kitty Hawk, North Carolina.

The fortieth anniversary of this epochal event, December 17, 1943, will come in the midst of the greatest war in history—a war in which the airplane will be the decisive implement of victory for democracy, decency and righteousness in the epochal struggle against aggression, brutality and slavery.

Before this global war and its tragic consequences had thrown a shadow over the face of the earth, the airplane was already revolutionizing the transportation and communications of the world. This swift messenger of peace and friendliness as between nations, this harbinger of a new world of trade and good will, had already served to bring the world closer together. In the miracle of this winged swiftness the farthest nations of the earth had been brought closer together in understanding and in commercial relationship. After the carnage of war is over and when victory is crowned, the airplane, immeasurably stimulated in its production and perfection, will prove the indispensable agency for rebuilding a disordered and mutilated world.

Under these circumstances, it is altogether fitting that the anniversary date of this world-changing event should be appropriately observed at the place of its occurrence.

Now, therefore, I, J. Melville Broughton, Governor of the State of North Carolina, do hereby designate Friday, December 17, 1943, as Kitty Hawk Day, and do hereby call upon all citizens of North Carolina, and in so far as I may be privileged to do so all citizens of an America grateful for the achievement of the Wright brothers, to give suitable observance to this deeply significant event, and further do call upon all who are vitally connected with the airplane industry in America and upon representatives of the Army and Navy and governmental agencies to designate and delegate official representatives to attend a suitable observance of this event which will be held at Kitty Hawk, North Carolina, on December 17, 1943, when and where appropriate tribute can be paid to the memory of Wilbur Wright, now deceased, and to Orville Wright, the surviving member of this world-famous partnership endeavor.

In witness whereof, I have hereunto set my hand and caused the Great Seal of the State of North Carolina to be affixed at Raleigh, the Capital, this the sixth day of October A.D. 1943.

J. Melville Broughton,
Governor

PREFERENCE RATINGS FOR LABORATORY EQUIPMENT

The Safety and Technical Equipment Division has issued the following explanatory statement (see Science, October 22, page 358) on preference ratings for laboratory equipment of all kinds.

Blanket MRO ratings, that is, ratings which are assigned without specifying the kind and quantity of material to which the rating is applied, may not be used for laboratory equipment, according to the provisions of Priorities Regulation No. 3. This restriction applies only to finished products and not to parts and materials for repair and maintenance of existing equipment. Such parts and materials may be purchased with blanket MRO ratings.

An exception to the rule against the use of blanket ratings is that ratings assigned under Orders P-43, P-56, P-58, P-68, P-73, P-89 and P-98b may be used for laboratory equipment even though they are blanket ratings. Blanket ratings assigned by CMP Regulation 5 and 5A may not be used, however.

Persons who need ratings and are not operating under one of these "P" orders should file PD 1A applications. However, where the purchase covers items on List A of Order L-144, the rating assigned in the authorized Form WPB 1414 may be used.

In reference to Order L-144 the division pointed out that the prospective purchaser should notify his supplier when he receives WPB authorization on Form WPB 1414 and should apply the authorized preference rating. Notification should be given by sending the supplier the certification described in paragraph (d)(2) of L-144 and the authorization should be retained by the purchaser.

A SURVEY OF MEDICAL COLLEGES

William L. Lawrence contributes to *The New York Times* an account of a survey of seventy-two leading American medical colleges which shows that "the severe reduction in teaching staffs and the accelerated program" have resulted in a lowering of standards in a fourth of the colleges and threaten "a serious situation in medical education."

A report on the survey, made by the executive council of the Association of American Medical Colleges, was read at Cleveland at the annual meeting of the association by Dr. Willard C. Rappleye, dean of the Faculty of Medicine, Columbia University, chairman of the council.

Dr. Rappleye stated that "Many schools report that about a third of their most active and able teachers have gone into service. Upon those remaining have fallen the tasks of carrying the instructional load and the care of patients in the wards of the teaching hospitals which in a normal academic year would be a heavy burden. But the accelerated program which requires instruction throughout the calendar year places a demand upon the staffs still in the schools which can be met only for a limited time."

According to Mr. Lawrence, nineteen of the schools reported that their staffs were now below the number necessary to provide reasonably satisfactory instruction and are greatly overworked. Many of the other fifty-three reported that they were at their minimum and any further withdrawals for military duty or by retirement or death would mean inability to maintain their programs.

From the data and comments obtained from the inquiry the following conclusions were drawn:

(1) Any further depletion of the instructional staffs of the medical schools will result in a serious breakdown of students of medical training. Already there is a definite deterioration of the quality of instruction in one fourth of the medical schools.

(2) The qualifications and educational preparation of trainees selected and assigned to the medical schools in the future must be kept high if even reasonable standards of academic performance are to be maintained under war conditions.

(3) If the present trend continues, consideration may have to be given to possible modification of the accelerated program to maintain proper instruction of medical officers for the Army and Navy and of physicians for the civilian needs of the future.

PERSONNEL PROBLEMS IN GEOLOGY

THE Office of Scientific Personnel of the National Research Council was established in 1941 primarily to aid in solving problems of scientific and technical personnel in connection with the activities of the National Defense Research Committee. During more than two years of its existence the office has handled successfully a large number of cases, chiefly in the field of physics, but also in other fields of science and engineering. The director of the office is Dean Homer L. Dodge, of the University of Oklahoma.

The needs of the Office of Scientific Research and Development and the availability of physicists and mathematicians have changed with the progress of the war. Therefore the Office of Scientific Personnel can now give more attention to fields other than those involved in the Office of Scientific Research and Development, some of which fields are suffering manpower shortages and can profit from the methods developed in this office for handling personnel problems in critical fields. The Geological Society of America is cooperating with several other scientific organizations to maintain the Office of Scientific Personnel for the remainder of 1943 and at least several months of 1944. During this time the effective machinery that has been built up by Dr. Dodge will be available to all geologists and their employers in the adjustment of wartime personnel problems.

The work of the Office of Scientific Personnel has been chiefly of two kinds: (1) placing qualified scientific and technical workers in positions connected with the war effort, and (2) taking steps to secure the deferment of scientists and technicians who can make their best contribution to the war effort by occupying civilian positions calling for their special skills. The office can serve in the first capacity to the extent that needs for geologists are reported and available geologists register. This service will be developed to meet the demand.

With respect to deferment problems, recent developments have made it uncertain how the office can best function. In the past, Dr. Dodge has assisted employers of physicists and mathematicians by writing letters to local Selective Service boards and state directors and by advising with officials in the National Selective Service Headquarters. Out of this work developed the National Committee procedure which is described in "Activity and Occupation Bulletin," No. 35, and which Dr. Dodge had hoped would be extended to include geologists in the near future. Instead, an entirely new procedure has been developed by the War Manpower Commission to be administered by the U. S. Employment Service.

The Division of Geology and Geography of the National Research Council has appointed a Committee of Geological Personnel, of which the chairman is W. B. Heroy, who is located in Washington. The primary function of this committee will be to coordinate personnel activities of the several geological societies; Dr. Dodge's office will consult with this committee in cases affecting geologists.

The Geological Society of America will prepare mimeographed statements of further helpful information as it becomes available. Those who have specific questions not answered in the present notice should address the Secretary, Geological Society of America, 419 W. 117th Street, New York, N. Y.

TERCENTENARY COMMEMORATION OF THE INVENTION OF THE BAROMETER, 1643–1943

A TERCENTENARY Commemoration of the Invention of the Barometer was held at the University of Toronto on October 19. There were afternoon and evening meetings.

Under the patronage of the Canadian Branch of the Royal Meteorological Society, the Royal Astronomical Society of Canada, the Royal Canadian Institute and the University of Toronto, two sessions were devoted to four papers indicating the origin and development of the barometer, discovered by Evangelista Torricelli in Florence in 1643.

The afternoon meeting was held in West Hall, Professor C. A. Chant presiding. The first paper was presented by Professor Louis C. Karpinski, of the University of Michigan, representative of the History of Science Society. This paper stressed the fact that Torricelli put together mentally the "force of the vacuum," 32 feet of water when the pump fails as given by Galileo, the weight of the air as determined by Galileo, and the pressure and resistance of the air and "various other fluids," as discussed by Galileo in connection with projectiles, arriving at the idea that if water was held up to 32 feet, mercury would be held up under the same pressure to 30 inches, as mercury approximates 14 times the weight of water.

Dean G. S. Brett, of the department of philosophy of the University of Toronto, dealt particularly with the philosophical aspects of the "horror of the void" and the effect of the creation of a vacuum on contemporary thought.

The evening meeting was held in the McLennan Physical Laboratory, with Director John Patterson, of the Canadian Meteorological Service, presiding. A comprehensive collection of modern developments of the barometer and ancient devices was on exhibition. These were arranged by W. E. Knowles Middleton, of the Canadian Meteorological Office, with the cooperation of Professor John Satterly, of the department of physics. Mr. Middleton gave an account of these various contrivances which remain to this day so essential for attempts to forecast the weather. Dr. Satterley gave a survey of the difficulties of development of the barometer as a precision instrument.

One classical experiment given by Torricelli in 1644 involved having the bowl of mercury supporting the mercury column large enough to hold water on top of the mercury sufficient to fill completely the tube holding the mercury. On lifting the tube to the point in the bowl where the mercury and water meet, the mercury drops almost instantly, and the water completely fills the tube that held the mercury. This experiment was successfully performed at both sessions.

President Cody, of the University of Toronto, presided at a dinner where toasts were given to the King of England, to President Roosevelt and to the three American delegates, including Dr. Andrews, of the Cleveland Great Lakes Weather Bureau, and Mr. Brumbacher, of Washington, members of the American Meteorological Society.

AMERICAN-SOVIET CONFERENCE

A CONFERENCE, sponsored by the National Council of American-Soviet Friendship, for which the following program has been arranged, will be held in New York City at the Hotel New Yorker on November 7:

PANEL: SOVIET SCIENCE AND TECHNOLOGY, 11:00 A.M.–1:30 P.M.

Chairman: DR. HAROLD C. UREY, professor of chemistry, Columbia University.

Sir Hubert Wilkins, explorer, "Soviet Exploration and Geography."

Dr. Carl O. Dunbar, curator, Peabody Museum, Yale University, "Advances in Soviet Geology and Mineralogy."

Dr. Charles E. Kellogg, soil scientist of the U. S. Department of Agriculture, "Soviet Soil Technology and Agriculture."

Dr. L. C. Dunn, professor of zoology, Columbia University, "Soviet Research in the Biological Sciences."

Dr. Selman Waksman, professor of microbiology, Rutgers University, "Bacteriology in the Soviet Union."

Dr. V. K. Zworykin, research director, R.C.A. Laboratories, "Soviet Developments in Electronics."

General Discussion.

PANEL: PUBLIC HEALTH AND WARTIME MEDICINE IN THE U.S.S.R., 2:30–5 P.M.

(the American-Soviet Medical Society cooperating)

Chairman: DR. WALTER B. CANNON, professor of physiology, Harvard University.

Dr. Hugh Cabot, Boston surgeon, "Russian Medicine Organized for War."

Dr. C.-E. A. Winslow, professor of public health, Yale University, "Public Health in the Soviet Union."

Professor Vladimir Lebedenko, Soviet surgeon, "Russian Advances in Military Medicine."

Soviet Motion Picture, "Experiments in the Revival of Organisms."

Dr. W. M. Stanley, Rockefeller Institute for Medical Research, "Soviet Studies on Viruses."

Dr. Alice Hamilton, medical consultant to the Federal Department of Labor, "Industrial Medicine in the U.S.S.R."

Dr. Wilder Penfield, professor of neurology, McGill University, "The Recent Surgical Mission to the U.S.S.R."

General Discussion.

THE TENTH ANNIVERSARY OF THE PLANETARIUM AND MUSEUM OF THE FRANKLIN INSTITUTE

THE Franklin Institute, Philadelphia, will celebrate on November 9, at three o'clock, the tenth anniversary of the opening of the Planetarium and Museum. The first session will be held in the Fels Planetarium, Wagner Schlesinger, director of the planetarium, presiding. The speakers will be James Stokley, General Electric Research Laboratories, first director of the planetarium; Colonel Philip Fox, Signal Corps, U. S. A., first director of the Adler Planetarium, Chicago; Demonstration of the Planetarium Instrument, Colonel Fox.

After an intermission the proceedings will be resumed in Franklin Hall at 4:15 in the afternoon, Charles S. Redding, president of the Franklin Institute, presiding. The program for the afternoon follows:

"Then and Now," The Honorable George Wharton Pepper.

Presentation by the president: Certificates of Honorary Membership to Philip Fox, Samuel S. Fels, Mary Curtis Zimbalist.

Presentation of Walter S. Gifford, president of the American Telephone and Telegraph Company, for the Vermilye Medal, Richard T. Nalle.

Address: "Industrial Management and Freedom from Want," Walter S. Gifford.

Reception and tea by the Hostess Committee.

The medal was awarded to Dr. Gifford "in recognition of outstanding contributions in the field of industrial management."

SCIENTIFIC NOTES AND NEWS

At the sesquicentennial commencement of Williams College, the doctorate of science was conferred on Dr. Alfred N. Richards, professor of pharmacology and vice-president in charge of medical affairs of the University of Pennsylvania, and on Professor Jerome C. Hunsaker, head of the department of mechanical and aeronautical engineering at the Massachusetts Institute of Technology.

At the celebration on October 27 of the centennial of the School of Medicine of Western Reserve University, honorary degrees were conferred as follows: the doctorate of science on Professor George H. Whipple, dean of the School of Medicine and Dentistry, University of Rochester, and on Dr. Reginald Fitz, of the Harvard Medical School; the doctorate of humanities on Dr. Frederick C. Waite, professor emeritus of histology at the university, and on Dr. William T. Corlett, Cleveland dermatologist, and the doctorate of laws on Dr. Torald H. Sollmann, dean of the School of Medicine at the university.

Dr. Sherwood Moore, director of the Mallinckrodt Institute of Radiology of Washington University, St. Louis, has been appointed by Surgeon General Parran a member of the National Advisory Cancer Council.

Nevin E. Funk, vice-president in charge of engineering of the Philadelphia Electric Company, was recently elected president of the American Institute of Electrical Engineers.

Dr. A. C. Furstenburg, dean of the Medical School of the University of Michigan, was named on October 27, at the closing session of the fifty-fourth annual convention, president-elect of the Association of American Medical Colleges.

H. P. Trevithick, of the bureau of chemistry of the New York Produce Exchange, has been elected president of the Association of Consulting Chemists and Chemical Engineers.

The title of professor emeritus has been conferred by the College of the City of New York on Dr. Frederick G. Reynolds, formerly professor of mathematics and chairman of the department, and on Dr. Axel L. Melander, formerly professor and head of the department of biology.

Dr. Joseph C. Aub, since 1928 associate professor of medicine in the Harvard Medical School, has been appointed professor of research medicine.

Dr. Ernst Gellhorn, professor of physiology at the College of Medicine of the University of Illinois, has taken up his work as professor of physiology at the Medical School of the University of Minnesota. He has been placed in charge of a special unit in neurophysiology for the study of infantile paralysis, sponsored by the National Foundation for Infantile Paralysis.

Dr. Henry G. Fisk, who has been in charge of ceramic and mineralogical research at the Armour Research Foundation of the Illinois Institute of Technology, has been appointed director of the newly established Research Institute of the University of Wyoming. He took up his new work on November 1. The Research Institute is the first institution of its kind in Wyoming. In conjunction with the university, its purpose is to aid by scientific research in the discovery, development and exploitation of the natural resources of the state.

Dr. I. A. Merchant, associate professor of veterinary hygiene at Iowa State College, has been appointed head of the department. Dr. Fay Farnum, of New York University, has been appointed assistant professor of mathematics.

Dr. Tevfik Saglam, professor of internal diseases in the faculty of medicine, has been appointed rector of the University of Istanbul.

It is reported in the *Journal* of the American Medical Association that as a result of the Ramirez government's order that all office holders who signed a recent pro-democratic manifesto be dismissed, professors of the highest standing in the universities of Argentina, including Dr. Bernardo A. Houssay and Professor Alejandro Ceballos, have been affected. Ramirez is understood to have stated that, besides being dismissed from public office, these men will not be allowed to leave the country.

Dr. Karl F. Heiser, director of the laboratory of psychology at Norwich State Hospital, Connecticut, has been appointed research director for the State Public Welfare Council.

Dr. Louis Waldbauer has resigned as associate professor of analytical chemistry and head of the analytical division of the department of chemistry and chemical engineering of the State University of Iowa, to become an analytical research chemist at the Central Research Laboratory of the General Aniline and Film Corporation at Easton, Pa.

DR. A. R. PATTON, head of research in the department of chemistry of the Montana Agricultural Experiment Station, has become a research chemist in the Biological Laboratory of E. I. du Pont de Nemours and Company, New Brunswick, N. J.

ARTHUR W. GELBKE, for the past two years director of engineering for American Type Founders, Inc., has been appointed chief engineer of E. Leitz, Inc., makers of Leica cameras and technical instruments.

COLONEL EDGAR ERSKINE HUME, Medical Corps, U.S.A., has been named chief American Health Officer of the Allied Military Government of Occupied Territory in Sicily.

IT is reported in *Chemical and Engineering News* that C. C. Concannon, chief of the Chemical Unit of the Bureau of Foreign and Domestic Commerce, Department of Commerce, planned to leave for Santiago toward the end of October to act as consultant and adviser to the Chilean Government on matters relating to the development of various branches of the chemical industry in that country.

DR. J. F. G. WHEELER, lately director of the Bermuda Biological Station for Research, has been appointed marine biologist in Mauritius. *Nature* states that it is hoped that Dr. Wheeler's researches may be a prelude to the establishment as a permanent institution of a Fisheries Department for Mauritius. The development of the island's fisheries has been made possible by a grant up to £4,500 under the British Colonial Development and Welfare Act of 1940.

DR. HAMILTON H. ANDERSON, professor and head of the department of pharmacology at Peiping Union Medical College, Peking, is reported to be one of a group announced by the State Department as being repatriated by the Japanese.

DR. F. J. W. ROUGHTON, F.R.S., fellow of Trinity College, lecturer in physiology at the University of Cambridge, will deliver the second Harvey Society Lecture of the current series at the New York Academy of Medicine on November 18. The title of his address will be "Recent Work on the Respiratory Chemistry of the Blood."

DR. EDWARD A. STRECKER, professor and head of the department of psychiatry of the School of Medicine of the University of Pennsylvania and consultant in psychiatry to the Army, Navy and Air Forces, delivered the annual Walter L. Niles Memorial Lecture at Cornell University Medical College on October 19, under the auspices of the Tau Chapter of Nu Sigma Nu. His subject was "The Neuropsychiatry of Global War." The lecture is given annually in memory of Dr. Niles, a former dean of the Medical College, where he was for many years professor of clinical medicine.

THE Johns Hopkins Medical History Club commemorated on November 1 the four-hundredth anniversary of the publication of Andreas Vesalius's De Humani Corporis Fabrica Libri Septem. Dr. George W. Corner was chairman of the program. An exhibit illustrating the life and work of Vesalius was displayed in the exhibition hall of the Institute of the History of Medicine.

COMMEMORATING the four-hundredth anniversary of Copernicus at Colby College, Dr. Harlan T. Stetson, of the Massachusetts Institute of Technology, gave on October 22 a lecture entitled "The Earth and the Sun, from Copernicus until To-morrow." He also addressed the College Assembly on "Science During the War and After."

THE two hundred and fifty-seventh meeting of the American Physical Society will be held in the Technological Institute of Northwestern University on November 12 and 13 under the presidency of Dr. A. W. Hull, of the General Electric Company. There will be a symposium on the physics of rubber and other high polymers on the morning of Friday. Special papers will be presented on Friday afternoon and all day on Saturday. The dinner of the society will be held at the Georgian Hotel, Evanston.

THE fifty-second annual meeting of the Society for the Promotion of Engineering Education will be held in Cincinnati from June 22 to 25, 1944.

THE Association of Military Surgeons of the United States met in Philadelphia on October 21. The program, devoted to war medicine, included such subjects as aviation medicine, battle fatigue, use of penicillin, rescue work of hospital ships, organization of medical units, technic of self-preservation, treatment of parachute injuries, war dentistry, reduction of venereal infection, war neurosis, jungle and desert emergencies, booby trap injuries, evacuation of the wounded by air and the use of dried plasma.

THE School of Medicine of Western Reserve University celebrated its centennial on October 27 with a convocation, preceded by an academic procession in which representatives of one hundred and thirty-eight universities and colleges, delegates of twenty-one learned societies and the consuls of seven countries participated. The principal address was delivered by Dr. Alan Gregg, director for the medical sciences of the Rockefeller Foundation. Professor Howard Thomas Karsner, director of the Institute of Pathology at the university, described the public service of the School of Medicine. The dinner address was given by Dr. Reginald Fitz, of the Harvard Medical School, who described the close relations during the last century between the Medical Schools of Harvard University and Western Reserve University.

THE centenary meeting of the Royal Anthropological Institute, London, was held on October 30 under the presidency of Professor J. H. Hutton. According to *Nature*, addresses were delivered by Sir John Myres on the work of the institute, and by Lord Hailey on "The Role of Anthropology in Colonial Development." There was a symposium on "The Future of Anthropology," in which Dr. G. M. Morant spoke on physical anthropology; Professor V. G. Childe on archeology; R. U. Sayce on material culture, and Professor R. Firth on social anthropology.

THE new home of the American Institute of Physics at 57 East 55th Street, New York City, it is hoped, if the exceptional obstacles of wartime can be overcome, can be opened at the time of the January meeting. The building, formerly a private house, will in the course of years become the headquarters of the offices of the institute and of some of its founder societies, the scene for conferences and committee meetings and generally the headquarters for American physics. The purchase price of $70,000, a bargain due to the generosity of the former owner of the house, has already been met to the extent of $51,000. The Building Fund Committee hopes to receive the contributions of those who intend to contribute but have not yet done so. Contributions should be addressed to the American Institute of Physics, 175 Fifth Avenue, New York 10, N. Y.

IT is proposed to establish a medical center at the College of Medicine of Wayne University, Detroit. The plan of development involves the expenditure of $50,000,000. A board of trustees has been incorporated, of which Dr. Edgar H. Norris, dean of the College of Medicine, is a member. Dr. Frank F. Tallman, Lansing, director of mental hygiene of the Michigan State Hospital Commission, has become adviser and consultant to the board, including the development of its Industrial Health Institute and psychiatric units. George F. Pierrot, director of the United Service Organizations in Metropolitan Detroit for the past seventeen months, has been appointed executive secretary of the finance committee. It is reported that an appropriation of $10,000 to initiate plans for the development of the center have been approved by the ways and means committee of the County Board of Supervisors.

DISCUSSION

THE BOTANICAL NAME OF THE GIANT SEQUOIA

IN the April number of *Leaflets of Western Botany*, W. A. Dayton, of the U. S. Forest Service, has presented a discussion of "The Names of the Giant Sequoia," based principally upon excerpts from 29 replies from certain Californian botanists in response to a request for information made by Mr. Dayton. The conclusions drawn are that botanical opinion in California (1) favors retention of *Sequoia gigantea* as the name of the big tree, (2) favors amendment of the international rules to conserve this name, and (3) indicates a reluctance to accept the recently proposed generic name Sequoiadendron. Some of the statements upon which these conclusions are based are rather amusing. One writer says he has "never seen or heard any name except *Sequoia gigantea*." Another says that the name *Sequoia gigantea* will remain in use because "millions of visitors come to this State [California] to view that tree." Another says, "Any change in the name would produce a distinct shock among 'plant lovers.'" Only two or three of the replies contain any reference to truly scientific or botanical considerations. I should like, therefore, to point out that since this is essentially a technical botanical question, it is to be decided on scientific grounds, without regard to the provincial enthusiasms of the residents of any particular part of the earth.

Clearly, there are only two fundamental points at issue. The first one is, Does the name selected conform to the International Rules of Botanical Nomenclature? The second question is, What are the basic biological facts? The first question I shall leave to the nomenclatural specialists, although it is worth while noting that the generally used name, *Sequoia gigantea* (Lindl.) Dcne., being a homonym, is untenable under the international rules. *Wellingtonia* also is ruled out, and for the same reason. The second question, however, calls for comment, since, after all, taxonomic botany *is* a branch of the science of biology.

While it is not at all necessary to review here the important data presented by Buchholz in 1939,[1] it may be not altogether out of place to quote briefly from the recently published work of two other botanists, Looby and Doyle,[2] who, presumably, may be safely considered free from any motives ulterior to the spirit of scientific inquiry. These two botanists have come independently to the conclusion, on the basis of their studies of the formation of megaspores, female gametophytes and archegonia, in both the big tree and the redwood, that the two species belong to different genera. Following is a quotation from their conclusions:

---

[1] *Am. Jour. Bot.*, 26: 535–538, 1939.

[2] *Sci. Proc. Roy. Dublin Soc.*, 23: 35–54, 1942.

> Buchholz (1939c) has recently published a short paper on the generic segregation of the Sequoias. In this he tabulates numerous differences between them, and concludes that they can not be retained as species of one genus. To these points others might be added, notably perhaps the difference in wood structure in typical specimens. Many of these points may be only such as are natural to different species, but the differences in proembryo and embryogeny are more important. When to these are added the further differences in development, outlined in this paper, in gynospore origin, in tapetum, in early prothallial growth and expansion, and in maturer cellular formation in the prothallus, it is clear that the two redwoods differ essentially in practically every phase of their life-history. In no other coniferous genus have such differences between species been recorded; on the contrary, true species of any other genus show extremely close similarities in their development. The other differences noted by Buchholz (1939c) are thus given greater importance, and we, therefore, without hesitation, agree with him that the Sierra Redwood, the Big Tree, commonly now known as *Sequoia gigantea*, can no longer be retained as a species of *Sequoia*, a generic title to which *Sequoia sempervirens* has priority claim. . . .

They go on to say that they prefer to use the generic name Wellingtonia, instead of Sequoiadendron, for the big tree. That is, however, beside the point. The significant facts are (1) the two species differ essentially in practically every phase of their life-history, and (2) in no other genus of conifers have such extreme differences between species been recorded. Additional biological evidence supporting the theory that the two species are more than specifically distinct was adduced as early as 1894 by Radais,[3] who proposed two subgenera of Sequoia, subgen. Eusequoia for *S. sempervirens* and subgen. Wellingtonia for *Sequoiadendron giganteum.* In 1931, Florin[4] pointed out that Arnoldi, in 1900, and Lawson, in 1904, had presented sufficient evidence from embryogeny to show the fundamental generic differences between the two species. Doyle,[5] in 1940, has indicated that the segregation of the big tree into a separate genus is fully justified.

It may be not altogether without significance that, although not proposed until 1939, the name Sequoiadendron already has been adopted by some of the most distinguished authorities on North American botany, including Alfred Rehder,[6] L. H. Bailey[7] and several others. During the last three years several articles, in which the name Sequoiadendron has been employed, have appeared in both European and American botanical journals.

G. NEVILLE JONES

UNIVERSITY OF ILLINOIS

THE APPARENT TIME ACCELERATION WITH AGE

HAVING for some time given a little attention to the physiology of aging and still having a fair memory at sixty-eight, I was more amused than instructed by the current discussion in SCIENCE of the apparent acceleration of time with advancing chronologic age. This discussion reminds one of the old quip: "Married men do not live longer than bachelors, it just seems longer," of which the truth and the why depend on the individual (and his mate). When we eliminate amnesia for current events and make the comparison in matters of approximately equal desirability, anxiety and boredom, there is no difference in the estimate of time speed at six and at sixty, so far as one can rely on memory. Death is obviously not in the category for comparison, because of the limited experience and understanding of youth. At the age of 7 to 10, when I greatly desired to reach the stature, the capacity and the dignity of a grown-up man, called to mind the prospect of a brief visit to my mother or longed for the end of the current day when sound slumber would shut out the perpetual baa-ah of the sheep in my care, the hours, weeks and years seemed *long* indeed. But in those same years a day's visit with mother, an hour in the swimming hole or fishing in the river passed with incredible speed. It is purely a question of the item of particular concern (desirable or objectionable) in the thought of the individual. Age has nothing to do with the illusion. For now at sixty-eight, the days, weeks, months and years of war drag on as slowly as they did sixty years ago when I wanted to grow up in a hurry. Then, I wanted (above all things) to be a man. Now, I want (above all things) mankind at peace. The time to attain either seemed and seems unduly long. On the other hand, a day at fishing, now, an hour at attempting to teach, a conference with intelligent colleagues, verily, *tempus fugit.*

A. J. CARLSON

UNIVERSITY OF CHICAGO

IN a recent discussion in SCIENCE on the apparent time acceleration with age, Frank Wilen made a statement, the implications of which I should like to dispute, especially since by so doing it will be possible to bring to the discussion some further matters of psychological interest.

---

[3] M. Radais, *Ann. Sci. Nat. Bot.*, ser. 7, vol. 19. Paris (thesis).

[4] Rudolph Florin. Untersuchungen zur Stammesgeschichte der Coniferales und Cordaitales. K. Svenska Vet.-Akad. Handl. ser. 3 vol. 10. Stockholm.

[5] *Nature*, 145: 900, 1940.

[6] "Manual of Cultivated Trees and Shrubs," second edition, 1940.

[7] "Hortus Second," 1941.

In referring to Pitkin's "Life Begins at 40," the statement was made that "Whatever consolations the author may have adduced to support the title, realists know that at forty life begins to end, that they have gone over the top of the hill and are coasting, brakeless, toward extinction." I am a little tired of the "realists," and am not willing to admit that they "know" anything of the kind. But let that pass.

The real point of interest is Wilen's implication that (1) all persons are afraid of old age and death, and (2) that those past middle life are more afraid of it than others. I consider that an unscientific generalization, not supported by the facts.

In the first place, many young persons are more afraid of death than their elders. When I was in my twenties I felt much as if I were walking a tight-rope over an abyss. This was not unique. Hugh Walpole once said that he was pleased when he became forty because he no longer felt that "disaster is waiting for me around the corner." And it has been a habit with me now, in view of my experience, to ask my older friends how they feel about the matter. There is reason to believe that most of them are sincere. About 10 per cent. have told me that they definitely fear old age and death, about 40 per cent. have told me that it "bothers them occasionally," while those of the remaining 50 per cent. are mostly indifferent. Many, like Walpole, actually feel more confident than do the young.

There must be some reason for this confidence. No doubt part of it results from an increase in economic and social security, but there is, I believe, another reason: that having lived for a certain period gives one a subconscious confidence that he will continue to live. This subconscious feeling is so strong that even the certain knowledge that death is coming can not eliminate it from the mind. This may explain the avarice of the aged. At least this seems a reasonable conception, and I should be pleased to have the reactions of other readers to it.

By the way, do those who criticize Pitkin's book ever read it? Mr. Pitkin has expressly emphasized, at the beginning of his book, that physically one is going down hill after forty. What he maintains is that many persons have their most interesting experiences and produce their best work after that age—which is something quite different from what most persons *suppose* the book implies.

CYRIL E. ABBOTT

DOANE COLLEGE

WHY does time appear to move faster as we grow older? In SCIENCE of July 30, an answer to this question was attempted by F. N. Nitardy which suggested a measurement of time as it relates to the individual. His impressive note called forth some interesting commentaries. Dondlinger points out that "the content of the elapsed time, that is, the events, occurrences, incidents and circumstances experienced during the elapsed time, is also a factor." This happens also to have been our own contribution to the discussion—we said something to this effect in an editorial. But we went farther than that; we dwelt morbidly upon what is happening *to* a person in middle age, rather than merely what is happening all around him, and suggested that cirrhosis of the liver, and the income tax, have something to do with the sensation that time is flying faster and the jig is about up. We have since noted, in Glass's recent "Genes and the Man," the suggestion, neatly parallelling Nitardy, that "the value of a year at any age is about equal to its proportion of the total life up to that age, so that a year to a child of ten has approximately four times the value of a year to a person of forty," but with the additional comment: "Our sense of time is not based on clocks or stars or even the alternation of day and night, but on the changes *within* us as we grow and develop." (Italics mine.)

Wilen takes the view that "there are at least limited circumstances in which the time-lapse sensation does not depend chiefly on age": if a man of sixty and a man of twenty are suffering extreme hardship on a life raft, both will find time dragging slowly along. A factor which none of these contributors has taken into consideration, apparently, is the psychological make-up of persons with relation to time. Of two persons of the same age, one feels he has a mission to accomplish, a great task to perform, and he is acutely aware of time's flight; the other, an easy-going sort who merely hopes to enjoy life without accomplishing much of anything, does not feel the acceleration to a comparable degree. A good example of the type of whom it has been written—

> But at my back I always hear
> Time's wingèd chariot hovering near

was Thomas Wolfe. Wolfe felt that he had a gigantic literary task to perform; he worked frenziedly to get it all out, and he produced magnificently. He was preoccupied with time and the briefness of man's days. Whether this terrific drive hastened his death, whether he had a premonition of his relatively early end, are debatable matters. It is hardly debatable that to such a man time moves far more rapidly than it does for his less dynamic, less intense, contemporaries.

R. P. HARRISS

BALTIMORE EVENING SUN

SCIENTIFIC BOOKS

LEGENDRE ASSOCIATED FUNCTIONS

Tables of Legendre Associated Functions. By ZAKI MURSI, Cairo: E. and R. Schindler. 1941. xii + 286 pp. 22.8 × 29.5 cm.

THIS is publication No. 4 of the Faculty of Science of the Fouad I University, in the Zaafaren Palace, Cairo, which became a state institution in 1925.

Legendre's polynomial of the nth degree, or zonal surface harmonic of the first kind, may be defined by

$$z = P_n(x) = \frac{1}{2^n n!} \frac{d^n(x^2-1)^n}{dx^n},$$

which is a particular solution of Legendre's equation,

$$(1-x^2) \frac{d^2z}{dx^2} - 2x \frac{dz}{dx} + n(n+1)z = 0.$$

The Legendre functions $P_n(x)$ were first introduced in a paper of Legendre published in 1785. Legendre's associated functions of the first kind, of the mth order and nth degree, are the functions $P_n^m(x)$ defined by the equation

$$P_n^m(x) = (1-x^2)^{\frac{1}{2}m} \frac{d^m P_n(x)}{dx^m}.$$

The present table gives values of $P_n^m(x)$ for $n = 1, 2, \ldots, 10$, $m = 1, 2, \ldots, 10$, and for x over the range [0.000(0.001)1.000]. These values are to eight decimal places in the beginning, and to three near the end, where the values are large. Some values are given to twelve significant figures.

For purposes of interpolation the utility of the table is greatly increased by the inclusion of columns of modified second differences, the theory of which was set forth by Dr. L. J. Comrie in the British *Nautical Almanac* for 1937. A 7-place table of Everett coefficients, for using these modified differences, is given on pages 282–283; four errata in the differences in the main body of the table are noted on p. 284. The next two pages contain an Arabic translation of the preface.

The author cherishes the hope that his table attains to a high degree of accuracy. The computations were carried out in duplicate, during the years 1937–41, by the author and three assistants. Dr. Comrie differenced 6,000 entries of the original calculations and thus found ten errors. Checking was also effected by comparison with one of A. H. H. Tallqvist's tables of 1908 (*Acta Societatis Scientiarum Fennicae,* v. 33, no. 9) for the range [0.00(0.01)1.00]. This table of Tallqvist may be regarded as the first of its kind, if the less extensive one given in his *Grunderna af Teorin för Sferiska Funktioner jämte Användingar inom Fysiken* (Helsingfors, 1905) is excluded. Mursi seems to have been ignorant of the existence of G. Prévost, *Tables de Fonctions Sphériques et de leurs Intégrales* (Bordeaux and Paris, 1933). Among other things this contains a table from $P_1^1(x)$ to $P_8^8(x)$, to not more than five places of decimals, with differences.

Thus Mursi's volume makes a notable new tabular contribution in an important field. The volume is clearly and neatly printed, and the paper is reasonably good. War conditions doubtless prevented the earlier distribution of the volumes. Up to four months ago even Dr. Comrie did not know of its publication. Since such an excellent publication is No. 4 of a series issued by the Faculty of Science of this Egyptian university, only eighteen years of age, the reader may be curious as to what works are represented by Nos. 1, 2 and 3. Although I have not seen these works I learn that they are as follows:

(1) H. Sandon, *The Food of Protozoa. A reference book for use in studies of the physiology, ecology and behavior of protozoa,* 1932.

(2) [Book of the Science of Algebra and Mathematics by Mohammed ibn Mûsâ al-Khowârizmî, with commentaries by Dr. Ali Moustapha Moehrafa Bey and Dr. Mohammed Moursy Ahmed] (in Arabic), 1937. An Arabic and English edition of this work by F. Rosen appeared at London in 1831. An Arabic and Spanish edition, by J. A. Sánchez Perez, appeared at Madrid in 1916. A Latin edition by Libri was given in his *Sciences Mathématiques en Italie,* vol. 1, Paris, 1838. L. C. Karpinski's edition of Robert of Chester's Latin translation of part of al-Khowârizmî's work was published with an English translation, at New York in 1915.

(3) Mohammed Hassib. *Cucurbitaceae in Egypt,* 1938.

R. C. ARCHIBALD

BROWN UNIVERSITY

MAN AND HIS PHYSICAL UNIVERSE

Man and His Physical Universe. F. C. JEAN, E. C. HARRAH, F. H. HERMAN and S. R. POWERS. 608 + vii pp. Ginn and Co. 1943. $3.25.

"MAN and His Physical Universe" is a text-book intended for a survey course in science. Such courses are taken by persons who do not intend to become professional scientists but who desire to be acquainted with the results of science for cultural or general educational reasons. The authors have approached the problem of presenting the results of the physical sciences by dividing the book into six "units," in which astronomy, physics, chemistry, meteorology and geology are discussed in turn. The sections are not given these classical titles, as the writers wish to show how each subject is of importance to mankind. Thus, the part on chemistry is called "Matter as Organized Energy Possesses Properties Which Are Indispensable to Man," and that on astronomy "Man's Increased Knowledge of the Cosmos Has Modified His Thinking." An integrated thread of continuity is in this manner woven through somewhat diverse material, and the bearing of all the sciences on man's thought and activities is developed.

In the first section the errors of ancient concepts are described and the scientific method explained. Some of the more recent findings of astronomy are set forth. From this, the authors proceed to demonstrate how superstitions have been demolished by knowledge, and how practical use is made of astronomy in determinations of time and geographical location. The second section explains how the distinctions between matter and energy are broken down, and the third describes the many possible chemical rearrangements of matter, including a chapter on organic chemistry and one on the way chemical products add to the conveniences and pleasures of living.

The fourth unit discusses the physics of the various forms of energy and shows how all may be applied. The fifth reviews the effects of meteorology on life. The final part of the book is devoted to a discussion of geology, starting with a review of the structure of the earth and showing how geological changes are continually in progress. The evolution of the present surface conditions of the earth is traced and finally the authors treat the practical importance of geological forces which make many mineral products available to mankind.

As is inevitable in a book jointly written by several authors, there are differences in quality between the several sections. Thus, for example, in the chapters on geology the illustrations are referred to in the text and serve to illuminate the subject-matter there discussed, while in those on astronomy and physics the photographs and diagrams are too often left for the instructor to explain. Nor is the choice of illustrations in these sections as good. In some cases, as on page 83, they are more complex than necessary and contain material requiring explanations not germane to the matter under discussion. Further explanations by the instructor will be necessary on page 272, where it is stated that energy is kinetic or potential, and the student is left to wonder just how heat energy and subatomic energy are to be fitted into these two categories. On the whole, this reviewer was left with the distinct impression that the authors of the parts on geology and chemistry were better able to expound their subjects in a clear and interesting manner which covered the essential points than were those on physics and astronomy. On the other hand, the sections on physics and astronomy do contain many simple and instructive treatments such as that on latent heat. The scientific method is both praised and explained, but the student is given little instruction in its use and few opportunities to practice it himself. It would seem proper to add some problems for quantitative computation to the admirable ones calling for general discussion.

This text should appeal to the average student who did not expect to study science beyond a survey course. The writers of this book have undoubtedly succeeded in presenting the results of recent investigations to non-scientists in an interesting manner, while, at the same time, explaining how these results are of importance to mankind.

S. A. KORFF

NEW YORK UNIVERSITY,
UNIVERSITY HEIGHTS

SPECIAL ARTICLES

PERFUSION OF RAT LIVERS WITH ESTROGEN IN VITRO[1]

THE role of the liver in metabolism of steroid hormones has been a matter of interest for some time. Since the experiments of Silberstein *et al.*[2] and of Zondek[3] on the incubation of natural estrogens with liver brei the original finding that the free hormone is rapidly inactivated has been generally substantiated. Confirmation has been attained by a variety of direct and indirect approaches, including: (a) damage of the liver of rats by administration of CCl_4 and the observation of increased end-effects of both endogenous[4] and exogenous estrogen;[5] (b) demonstration of the ineffectiveness of estrogen crystals or pellets placed in sites drained by the hepatic portal systems[6, 7] with similar inactivation on direct injection into the spleen;[8]

---

[1] Aided by grants from G. D. Searle and Company and the National Research Council Committee for Problems of Sex.

[2] F. Silberstein, P. Engel and K. Molnar, *Klin. Wochsch.*, 12: 1693, 1933.

[3] B. Zondek, *Skand. Arch. Physiol.*, 70: 133. 1934.

[4] N. B. Talbot, *Endocrinol.*, 25: 60, 1939.

[5] G. Pincus and D. W. Martin, *Endocrinol.*, 27: 838, 1940.

[6] G. R. Biskind and J. Mark, *Bull. Johns Hopkins Hosp.*, 65: 212, 1939.

[7] G. R. Biskind, *Endocrinol*, 28: 894, 1941; *Proc. Soc. Exp. Biol. Med.*, 47: 766, 1941.

[8] A. Segaloff and W. O. Nelson, *Proc. Soc. Exp. Biol. Med.*, 48: 33, 1941.

(c) perfusion of a heart-lung-liver preparation (dog) with estrone and the observation of inactivation in a few minutes with little or no inactivation by a control heart-lung preparation;[9] (d) incubation of various estrogens with liver slices.[10,11,12] Experiments involving the administration of estrogen and the isolation of excretion products from the urine have demonstrated that *in vivo* estradiol and estrone are intraconvertible in test animals and men, and that estrone is converted in large part to estriol by human male subjects (for a recent review see Doisy *et al.*,[13] Pincus and Pearlman,[14] also Schiller and Pincus).[15] The probabilities of such conversion by the liver have been investigated only by the experiments of Heller,[10,11] who obtained evidence for an apparent irreversible destruction of α-estradiol by rat liver slices and a probable conversion of estrone to α-estradiol which is rapidly destroyed.

We have undertaken the perfusion of intact rat livers with α-estradiol dissolved in a perfusion medium usually consisting of a mixture of Ringer-Locke solution and defribinated rat blood (see Table 1). Under aseptic conditions female adult rats in proestrus or estrus were rapidly bled, the liver *in situ* was then washed through with Ringer-Locke solution, dissected and cannulated through the portal vein, care being taken that the cannula contained Ringer-Locke solution to prevent air-embolism formation. The cannulated specimen was mounted in a perfusion apparatus having a pulsating flow of 70 beats per minute with a pressure at the portal vein sufficient to ensure a flow through the organ of 3 cc of aerated medium per minute (approximately 120 mm Hg). The entire apparatus was incubated at 37° C.

In order to recover the estrogens from the perfusing medium the following extraction was employed: (a) addition of an alcohol-ether mixture (3 parts 95 per cent. ethyl alcohol to one part ethyl ether) using 18 cc for each cc of blood or serum in the medium; (b) washing the precipitate formed with 95 per cent. ethyl alcohol using one-fourth to one-half the volume of the original alcohol-ether mixture; (c) the clear filtrates of (a) and (b) are combined, the ether and alcohol evaporated off and the watery residue extracted thoroughly with ethyl ether; (d) the ether extract is washed with 1 N NaOH to remove the estrogens, which are concentrated by acidifying the NaOH, extracting again with ether and evaporating the water-washed ether extract to dryness. An aliquot of this phenolic fraction is assayed with spayed rats by a modified Allen-Doisy method.[16] Separation of the phenolic extract into three fractions segregating principally estradiol, estrone and estriol respectively, is accomplished by methods previously described.[17,18] Hydrolysis of the perfusate when performed was accomplished by autoclaving at 14 pounds pressure for twenty minutes at pH 1–2.

Since it has been adequately demonstrated by Zondek[19] that rat blood exerts no effect on added estrogen, we have contented ourselves with a single one-hour perfusion through the apparatus of 3,200 r.u. of α-estradiol with perfusing medium alone (20 cc defibrinated blood plus 100 cc Ringer-Locke solution). We recovered 3,000 r.u., the 200 r.u. lost probably representing losses in manipulation although it is within the limits of error of our assay method (± 15 per cent.). Similarly 300 r.u. of α-estradiol was recovered completely in two incubations of 3 and 17 hours, respectively, with rabbit serum. Rabbit serum itself extracted by our methods contains no detectable estrogenic activity (less than 1 r.u. in 18 cc).

In Table 1 we present data from typical perfusion experiments. They demonstrate: (a) that with the larger amounts of α-estradiol the total activity of the perfusing fluid disappears rapidly, being reduced to less than one third in three hours (experiments 1, 2, 3, 4) and to approximately one sixth in six hous (experiments 2 and 4); (b) that this loss of activity is principally due to the formation of the less potent estrogens estrone and estriol (experiments 1 and 2); (c) that with smaller amounts of perfusing α-estradiol the loss of activity is more rapid (experiment 5) being practically complete on perfusion with 208 r.u. for 5 hours (experiment 6) since the liver perfused with medium alone yields a similar small unitage (experiment 7); (d) that acid hydrolysis of the three-hour (experiment 3) or six-hour (experiment 4) perfusate fails to increase the total activity, nor does the hydrolysate obtained enhance or diminish the activity of added α-estradiol (experiment 3); (e) that perfusion of the rat heart for three hours results in no conversion of perfusing α-estradiol, since the recovery observed in experiment 8 is practically all in the

---

[9] S. L. Israel, D. R. Meranze and C. G. Johnston, *Am. J. Med. Sci.*, 194: 835, 1937.

[10] C. G. Heller, *Endocrinol*, 26: 619, 1940.

[11] C. G. Heller and E. J. Heller, *Endocrinol.*, 32: 64, 1943.

[12] G. H. Twombly and H. C. Taylor, *Cancer Res.*, 2: 811, 1942.

[13] E. A. Doisy, S. A. Thayer and J. T. Van Bruggen, *Federation Proc.*, 1: 202, 1942.

[14] G. Pincus and W. H. Pearlman, *Vitamins and Hormones*, 1: 293, 1943.

[15] J. Schiller and G. Pincus, *Arch. Biochem.*, 2: 317, 1943.

[16] G. Pincus and W. H. Pearlman, *Canc. Res.*, 1: 970, 1941.

[17] G. Pincus and W. H. Pearlman, *Endocrinol.*, 31: 507, 1942.

[18] W. H. Pearlman and G. Pincus, *Jour. Biol. Chem.*, 147: 379, 1943.

[19] B. Zondek, "Clinical and Experimental Investigations on the Genital Functions and their Hormonal Regulation." Williams and Wilkins, Baltimore, 1941.

TABLE 1

THE RECOVERY OF ESTROGENIC ACTIVITY FROM THE PERFUSING MEDIUM IN VARIOUS PERFUSIONS OF RAT ORGANS *in vitro* WITH α-ESTRADIOL

Experiment No.	Organ perfused	Perfusion medium	Amount of α-estradiol in perfusate (r.u.)	Perfusion time (hours)	Activity recovered from perfusate (r.u.)*				Remarks
					Total	Weak phenolic non-ketonic (estradiol)	Weak phenolic ketonic (estrone)	Strong phenolic (estriol)	
1	Liver	25 cc defibrinated blood, plus 100 cc Ringer-L.	3200	3	1000	400	400	200	
2	"	20 cc defibrinated blood, plus 100 cc Ringer-Locke	3200	6	570	220	220	132	An aliquot taken at 3 hrs. assayed 1000 r.u.
3	"	25 cc defibrinated blood, plus 100 cc Ringer-Locke	4080	3	1200† 1000‡	...	...	...	¼ of total plus 416 r.u. of α-estradiol assayed 700 r.u. ¼ of total acid hydrolyzed plus 416 r.u. α-estradiol assayed 730 r.u.
4	"	80 cc rabbit serum plus 15 cc Ringer-Locke	1664	6	134† 128‡	...	...	...	
5	"	25 cc defibrinated blood, plus 100 cc Ringer-Locke	300	3	43	...	...	...	
6	"	20 cc defibrinated blood, plus 100 cc Ringer-Locke	208	5	15	...	...	...	
7	"	25 cc defibrinated blood, plus 100 cc Ringer-Locke	0	3	14	...	...	...	
8	Heart	50 cc rabbit serum plus 75 cc Ringer-Locke	300	3	270	270	4	0	

* By our assay method 1 r.u. = 0.125 microgram α-estradiol, 1.0 microgram estrone, 1.0 microgram estriol.
† By routine extraction (see text).
‡ After acid hydrolysis (see text).

estradiol fraction, the small amount (4 r.u.) in the estrone fraction being accountable to fractionation error.

These data controvert the findings of Heller[10] and Zondek[19] that α-estradiol is not converted to other estrogens by liver *in vitro*. It is possible that autolyzed tissue, as represented by liver slices or brei, may release substances (enzymes or oxidants) that are destructive, whereas the intact organ exerts no such effect. Macroscopic examination of the livers of these experiments gave no indication of retrogression or autolysis. Our data do indicate that the liver may normally be concerned in the conversion of α-estradiol to estrone and estriol observed in injection and urinary recovery experiments.[15, 20, 21]

A fractionation of the urine of male rats receiving estrone by injection indicates a similar conversion by the intact animal; furthermore, partially hepatectomized animals show less destruction of the exogenous estrogen and also less conversion than normal animals (Schiller, unpublished data).

It is notable that these data give no indication of estrogen detoxification by the perfused rat liver. Either conjugation occurs at a much slower rate than conversion or the participation of another organ is requisite. Alternatively, the conditions of our experiments result in a breakdown of a detoxifying mechanism in the liver.

Details of these and related experiments will be published elsewhere.

JOSEPH SCHILLER
GREGORY PINCUS
THE PHYSIOLOGICAL LABORATORIES,
CLARK UNIVERSITY,
WORCESTER, MASS.

INABILITY TO PASS PRIMARY ATYPICAL PNEUMONIA TO HUMAN VOLUNTEERS[1]

THE chief obstacle facing investigation of the etiology of primary atypical pneumonia (pneumonitis) has been the lack of suitable laboratory animals which regularly exhibit pneumonia after intranasal inoculation with throat washings, sputum or lung specimens from sick patients.

Stokes *et al.*[2] and Reimann[3, 4] among others have reported indifferent results after previously obtaining a passage virus. Recently Dingle *et al.*[5] have reported

---

[20] G. Pincus, *Symposium Quant. Biol.*, 5: 44, 1937.

[21] G. V. Smith and O. W. Smith, *Am. Jour. Obst. Gynec.*, 39: 405, 1938.

[1] Published with the approval of the chief of the Bureau of Medicine and Surgery, United States Navy.

[2] J. Stokes, Jr., A. Kenny and D. Shaw, *Trans. Coll. Phys.*, 6: 329, 1939.

[3] H. Reimann and J. Stokes, Jr., *Trans. Asn. Am. Phys.*, 55: 123, 1939.

[4] H. Reimann and W. Haven, *Arch. Int. Med.*, 65: 138, 1940.

[5] J. Dingle *et al.*, *War Med.*, 3: 223, 1943.

that an agent isolated by one of their group could be passed directly to the cotton rat, but not after filtration through a Berkefeld N filter. The relation of this virus to pneumonitis has not yet been established.

Following an outburst in 1942 of continued and sporadic cases of primary atypical pneumonias, occurring in male personnel, several hundred mice, 12 ferrets and 8 hamsters were given intranasal inoculations of pooled and unpooled throat washings and sputa from acute x-ray positive cases. The results obtained were insignificant. Mice would die with some regularity if unfiltered washings were used. Where Berkefeld V filtration of throat washings and ground sputum was used intranasally, occasional mice of a series would die in 7 to 12 days, or longer, but successive serial transfers of the sterile lung suspensions were negative.

In 1942, sputum and nasal washings were collected from twelve patients (subsequently Lygranum negative) exhibiting typical symptoms by roentgenogram of severe primary atypical pneumonia. Their sputum and nasal washings were suspended in veal infusion broth emulsified by grinding and shaking and filtered through Berkefeld V candles. Previous experiments with N filtrates had already been found to be negative for mice and 2 human volunteers.

The veal infusion filtrates were given intranasally to 5 human volunteers in amounts from 20 to 40 cc each. The volunteers remained healthy and did not subsequently exhibit signs of illness. Control mice also remained healthy.

The use of human volunteers is reported. The negative results obtained are consistent with the apparent relatively low degree of infectivity.

The twelve patients mentioned were Naval personnel. The five human volunteers were non-military personnel.

Deane H. Vance,
Commander, M.C., U.S.N., Ret.
Thornton Scott,
Lieutenant, M.C., U.S.N.R.
U. S. Navy Pre-Flight School,
Chapel Hill, N. C.

Herman C. Mason
Department of Bacteriology and Immunology
University of North Carolina

SCIENTIFIC APPARATUS AND LABORATORY METHODS

STERILITY TEST FOR PENICILLIN

With the introduction of the use of penicillin in the successful treatment of systemic and wound infections caused by many gram positive and some gram negative bacteria,[1, 2, 3, 4, 5, 6] the necessity of providing a suitable method for neutralizing the antibacterial effects of this highly active substance prior to sterility test becomes apparent. The approach used in developing a satisfactory method for testing penicillin for sterility involved a consideration of some chemical or physical agent which would inactivate the substance completely and yet in itself have no antibacterial effects on possible contaminating organisms in the product.

Among the various agents tested, which appeared to meet the necessary requirements given, were two enzyme preparations, Taka-diatase and particularly Clarase,[7] a more active diastatic enzyme system. These enzymes were found to inactivate the antibacterial effects of penicillin in two hours or less when incubated in the presence of the agent in a water bath at 40° C and tested by the Oxford cup-plate method. Taka-diastase was effective under these conditions at pH 6.0 and 8.0 but not in buffer solution of pH 4.0. Clarase, on the other hand, neutralized penicillin activity completely at all the pH ranges given. Additional studies on the relative inactivating actions of the two preparations indicated that while Taka-diastase was effective in this test in dilutions of 1:200, a similar action was had with Clarase in a final dilution of 1:4,000.[8]

Since it was found that relatively high dilutions of Clarase would neutralize the antibacterial effects of penicillin when tested by the Oxford cup-plate procedure, it appeared worth while to study the effects of the enzyme system against the agent in the presence of a fluid medium. This study was carried out as follows: A 1 per cent. stock solution of Clarase was prepared in buffer solution, of pH 7.0 and sterilized by Berkefeld filtration. Samples of sodium penicillin powder,[9] as received in the sterility control laboratory, were inoculated with dry cultures of *Clostridium tetani, Clostridium septique, Bacillus subtilis, Eber-*

---

[1] E. P. Abraham, E. Chain, C. M. Fletcher, A. D. Gardner, N. G. Heatley, M. A. Jennings and H. W. Florey, *Lancet*, 2: 177, August 16, 1941.

[2] J. E. Bordley, S. J. Crowe, D. A. Dolowitz and K. L. Pickrell, *Ann. Otol., Rhin. and Laryngol.*, 51: 891, 1942.

[3] M. E. Florey and H. W. Florey, *Lancet*, 1: 387, March 27, 1943.

[4] W. E. Herrell, *Staff Meet. Mayo Clin.*, 18: 65, 1943.

[5] W. E. Herrell, E. N. Cook and L. Thompson, *Jour. Am. Med. Asn.*, 122: 289, 1943.

[6] C. H. Rammelkamp and C. S. Keefer, *Am. Jour. Med. Science*, 205: 342, 1943.

[7] "Standardized" Clarase from the Takamine Laboratories, Clifton, N. J.

[8] Details of this and additional studies on enzymes *vs.* penicillin to be published elsewhere.

[9] 10 mg containing approximately 240 units per mg.

thella typhi, Escherichia coli and *Staphylococcus aureus*. To the dry contaminated powders was added 2 cc of the prepared Clarase solution. The enzyme penicillin solutions or suspensions were transferred immediately to several tubes of Brewers' fluid thioglycollate medium (approved medium of the National Institute of Health). The contents of the tubes were mixed thoroughly by swirling and placed at 37° C to incubate. A luxuriant growth of the inoculated test organisms was had in all tubes at the end of 48 hours. Control tubes containing gram-positive organisms and penicillin, but without enzyme, failed to show evidence of visible growth at the end of 7 days incubation. However, many of the tubes containing gram-negative organisms and penicillin without enzyme showed some growth after several days. These results could be expected on the basis of known resistance of most gram negative bacteria to the antibacterial agent.

Method: With the information obtained in this and additional studies, the following method for routine sterility tests on penicillin powder is proposed. A stock of 1 per cent. sterile solution of Clarase in phosphate buffer, pH 7.0, is distributed in 2 cc amounts in sterile cotton plugged test-tubes or in ampules which may be sealed. The sterile enzyme solution, stored in a refrigerator, will retain its anti-penicillin activity for a period of at least two months. The contents of an ampule of penicillin are dissolved or suspended in 2 cc[10] of prepared Clarase solution and transferred immediately to tubes of Brewers' fluid thioglycollate medium. The inoculated tubes are placed at 37° C. and examined for possible bacterial contamination throughout a period of 7 days. An additional 7 days incubation should be allowed for detection of possible mold contamination.

C. A. LAWRENCE

RESEARCH LABORATORIES OF
WINTHROP CHEMICAL COMPANY, INC.,
RENSSELAER, N. Y.

QUIETING PARAMECIUM FOR THE ELEMENTARY STUDENT

THIS new mechanical method of "hog-tying" Paramecium for classroom study has proved to be completely reliable and "foolproof" in the hands of our large student body at Washington Square College, New York University. It is somewhat simpler and more stable than the method reported recently in SCIENCE,[1] and much more dependable than any of the older methods.

The method depends upon the high viscosity, the low tonicity and the non-toxic properties of a methyl cellulose solution; and upon the fact that this solution displays very little change of viscosity as it is warmed (as by the lamp of the microscope). Best results are obtained by using a ten per cent. solution of methyl cellulose (Dow Chemical Company; viscosity type, xx low). Place one large drop of this solution on a slide in contact with an equal-sized drop of the Paramecium culture, stir the two drops together with a toothpick, put on a cover slip (no bristle or other support is necessary), and the preparation is ready for immediate study.

The slowing effect of this solution is remarkable. Now it takes the specimen about ten minutes to cross the high power (4 mm) field. Nevertheless, the form remains altogether normal, and even the rotational character of the locomotion is retained. The ciliary beat is so slow that it is quite easy to differentiate the "active" and "recovery" phases of the strokes. The progressive passage of the individual food vacuoles throughout the body can be followed (especially if a little carmine suspension is added to the culture just before mixing with the cellulose solution), and the process of defecation can be observed, as the specimen leaves a trail of fecal granules along the slow path of its progress. The untrained student also finds little difficulty in getting a good look at the other structures of the specimen, including the pulsating contractile vacuole, the gullet and undulating membrane, the trichocysts and in some cases even the macronucleus.

The further advantages of this method are inherent in the stability of the methyl cellulose solution and of the resulting "wet mount." Even without sterilization and at room temperature, the stock cellulose solution will keep for months. The "wet mount," due to the very slow evaporation of the solution, far outlasts any ordinary preparation. Without any attention at all, it does not deteriorate appreciably in two to three hours.

DOUGLAS A. MARSLAND

WASHINGTON SQUARE COLLEGE,
NEW YORK UNIVERSITY

BOOKS RECEIVED

BERT, PAUL. *Barometric Pressure. Researches in Experimental Physiology*. Illustrated. Pp. xxxii + 1055. College Book Company, Columbus, Ohio.

BULL, HENRY B. *Physical Biochemistry*. Illustrated. Pp. iv + 347. John Wiley and Sons. $3.75.

DIXON, MALCOLM. *Manometric Methods as Applied to the Measurement of Cell Respiration and Other Processes*. 2nd edition. Illustrated. Pp. xiv + 155. Cambridge University Press. $1.75.

PORTER, C. W. and T. D. STEWART. *Organic Chemistry*. Illustrated. Pp. v + 577. Ginn and Company.

STEWART, ISABEL MAITLAND. *The Education of Nurses*. Pp. xi + 399. Macmillan Company. $3.50.

WHITEWAY, HELEN LOUISE. *Scientific Method and Conditions of Social Intelligence*. Pp. x + 188. Teachers College, Columbia University. $2.00.

---

[10] This quantity of Clarase solution will inactivate as much as 50 mg of penicillin containing a total of potency of 10,000 or more Oxford units.

[1] John B. Buck, SCIENCE, 97: 2526, 494, May 28, 1943.

SCIENCE

Vol. 98 FRIDAY, NOVEMBER 12, 1943 No. 2550

Recent Advances in Viruses: DR. EDWIN H. LENNETTE 415

Obituary:
- *Felix Aguilar:* DR. OTTO STRUVE. *Deaths and Memorials* 423

Scientific Events:
- *Gifts to the Royal College of Surgeons, England; Report of the Committee on the Professional Training of Chemists; The Dysentery Registry; Rare Chemicals; Program of the Lancaster Branch of the American Association; The Pacific Division of the American Association; The American Philosophical Society; The Charles L. Mayer Award of the National Academy of Sciences* 424

Scientific Notes and News 427

Discussion:
- *A Possible Relationship between the Walnut Erinose Mite and Walnut Blight:* DR. B. A. RUDOLPH. *Another Discovery of Chaos Chaos:* PAUL F. BRANDWEIN, PATRICIA PENN and CLARE SHIEL. *Tennyson's Prediction of the Invention, Use and Misuse of the Aeroplane:* PROFESSOR M. F. ASHLEY MONTAGU 430

Scientific Books:
- *Heat Engines:* DR. HOWARD W. EMMONS 432

Special Articles:
- *The In-Vitro Destruction of Carotene by Water Extracts of Minced Rat Stomachs in the Presence of Methyl Linolate:* DR. E. L. HOVE. *An Unidentified Nutrient Required for Proper Utilization of Dl-Alpha-Tocopherol by the Chick:* DR. HOMER PATRICK and PROFESSOR C. L. MORGAN 433

Scientific Apparatus and Laboratory Methods:
- *A Method for Indicating the Moisture Content of Foods during Dehydration:* DR. GEORGE BOUYOUCOS and PROFESSOR H. A. CARDINELL 435

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

RECENT ADVANCES IN VIRUSES[1]

A BRIEF SURVEY OF RECENT WORK ON VIRUSES AND VIRUS DISEASES[2]

By Dr. EDWIN H. LENNETTE

SERVIÇO DE ESTUDOS E PESQUISAS SÔBRE A FEBRE AMARELA (YELLOW FEVER RESEARCH SERVICE)[3]

To formulate at the present time a concise, accurate and invariant definition of a virus is impossible due to the insufficiency of our knowledge concerning the nature of these disease incitants. Because the infectious agents classified as viruses possess the capacity to multiply or reproduce, because they showed marked specificity under natural conditions for certain hosts and tissues, are able to adapt themselves to new environmental conditions and to undergo variation, it is customary to regard them as living organisms. In the past viruses were characterized, and thus differentiated from bacteria, by the possession of a size at or below the limits of resolution possible with the usual microscopic methods, by their ability to pass through mineral or collodion filters which hold back bacteria, and by their total inability to reproduce in lifeless bacteriologic media. We now know, however, that invisibility and filtrability do not constitute valid criteria—some infectious agents possessing all the attributes of a virus and classed as such are visible and approximate the smallest bacteria in size while others pass with difficulty, or not at all, through filters which permit passage of the smallest bacteria. From the biologic standpoint the outstanding difference between viruses and bacteria appears to lie in the inability of viruses to propagate unless living cells are present; yet on closer analysis even this difference approximates the relative rather than the absolute in degree. Certain pathogenic bacteria, such as *Hemophilus influenzae* and *Pasteurella tularensis,* have become so highly parasitic that their nutritional requirements are

---

[1] Received for publication October 25, 1943.

[2] Presented on July 6, 1943, before the Seminario de Biologia, held in Rio de Janeiro from July 2 to 6, 1943, under the auspices of the University of Brazil.

[3] Maintained jointly by the Ministry of Education and Health of Brazil and the International Health Division of The Rockefeller Foundation.

met only by media containing animal tissues or tissue extracts, a condition which implies that certain enzyme systems vital to free-living forms are lacking. Viruses presumably possess even fewer enzyme systems, so few that only living cells can provide them with the conditions essential to multiplication.

The biologic position of the viruses is still uncertain, although a link to the recognized bacteria may perhaps exist through the rickettsiae, which some of the larger viruses resemble in certain respects, such as size, developmental cycles, tinctorial properties, etc.

THE NATURE OF VIRUSES

The numerous early attempts to gain insight into the nature and properties of the viruses were seriously hampered by the unavoidable use of crude extracts of infected tissues. Attempts at purification by chemical or physicochemical means were not lacking, but were attended with the loss of so much activity that the preparations were unsatisfactory for study.

The success of Stanley[4] in 1935 in isolating by chemical means from the juice of tobacco plants infected with tobacco-mosaic virus a crystalline protein possessing the properties of the virus gave new impetus to this field. While purely chemical methods on the whole have been found unsuitable for purification of viruses not endowed with the unusual stability of tobacco-mosaic virus, the development of the high-speed vacuum centrifuge has provided a valuable alternate method for purifying and concentrating virus preparations. Optical, ultracentrifugation, viscosity, diffusion, x-ray and other physical, as well as chemical, studies have been carried out on such purified preparations; the significance of some of the information obtained by correlating data from examinations by these methods is presented below.

It has been found possible to concentrate and purify the less stable viruses by repeated centrifugation in a high-speed air-driven vacuum centrifuge.[5, 6] The procedure depends on the use of alternate cycles of low and high speed. Material thrown down at low speed (about 10,000 g) is discarded while sediments produced at high speed (*e.g.*, 50,000 g) are resuspended and subjected to another cycle of low- and high-speed centrifugation. The cycles are repeated until a homogeneous final preparation is achieved. The degree of homogeneity of the suspension as well as the particle size of the suspended material is checked in an analytical ultracentrifuge.[5, 6]

The end-product obtained by repeated alternate high- and low-speed centrifugation is a protein with which are associated all the properties of the virus. Ultracentrifugal analysis of such virus proteins indicates that they possess remarkable molecular homogeneity. Calculations of the molecular weights of the virus-proteins from their sedimentation constants show that these proteins are unusual in that they are composed of molecules much larger than those of any proteins previously described.[7] Thus, the tobacco-mosaic virus, one of the most intensively investigated, has a molecular weight of forty-three million, computed in accordance with the known asymmetry of the virus particles.[8] The viruses of rabbit papilloma[9] and of eastern equine encephalomyelitis,[10] whose particles are assumed to be spherical, have molecular weights in the neighborhood of twenty million. As pointed out by Stanley[7] the virus proteins have many of the properties of ordinary molecules, and because of their tremendous size he groups them with the macromolecules of the colloidal chemist.

The validity of the figures assigned for molecular weight or for particle shape, for example, has been checked, whenever feasible, by one or more additional methods, singly or in combinations. The plant viruses have been the most intensively studied and tobacco-mosaic virus protein is chosen here as an illustrative example; the data presented are taken from a recent review by Lauffer and Stanley.[8a] Tobacco-mosaic virus protein occurs in the liquid crystalline (mesomorphic or paracrystalline) state, and the crystals are held to be true crystals since they are double-refractive and on x-ray analysis give a typical crystalline pattern. This ability to exist in a liquid crystalline state implies that the molecules have a rodlike structure, an implication supported by the findings that the virus protein shows double refraction of flow, positive electrical birefringence and the Ganz depolarization effect. If the constants for sedimentation, specific viscosity, specific volume, diffusion and rotational diffusion for a virus protein, are known it is possible by use of the appropriate equations and various combinations of these constants to ascertain the size, shape and weight of the virus molecule. By such means the tobacco-mosaic virus protein has been calculated, as mentioned above, to have a molecular weight of forty-three million and to consist of asymmetric particles approximately 280 mμ × 15 mμ.[8b] X-ray diffraction data also indicate that the particles have a diameter of 15.2 mμ and a length greater than 120 mμ.

---

[4] W. M. Stanley, SCIENCE, 81: 644–645, 1935.

[5] T. Svedberg and K. O. Pedersen, "The Ultracentrifuge." Clarendon Press, Oxford, England, 478 pp., 1940.

[6] E. G. Pickels, *Chem. Reviews*, 30: 341–345, 1942.

[7] W. M. Stanley, *Jour. Phys. Chem.*, 42: 55–70, 1938.

[8] a. M. A. Lauffer and W. M. Stanley, *Chem. Reviews*, 24: 303–321, 1939. b. W. M. Stanley and C. A. Knight, *Cold Spring Harbor Symposia on Quantitative Biology*, 9: 255–262, 1941.

[9] J. W. Beard and R. W. G. Wyckoff, SCIENCE, 85: 201–202, 1937.

[10] A. R. Taylor, D. G. Sharp, Dorothy Beard and J. W. Beard, *Jour. Infect. Dis.*, 72: 31–41, 1943.

With the exception of vaccine virus, which is relatively quite stable, as well as being one of the largest known viruses, the animal viruses have enjoyed but little attention compared to the plant viruses. The large particle size of vaccine virus makes feasible its purification and concentration by comparatively simple centrifugational procedures, so that pure preparations of this virus have long been available for study. Infectivity of such preparations is attributed to the elementary bodies, which are sufficiently large to be examined under the ordinary microscope. Data derived from filtration of the virus through graded collodion membranes indicate that the virus has a particle size of 125 mμ to 175 mμ.[11] Barnard (according to Elford and Andrewes)[12] estimated the particle size, from photomicrographs taken with ultraviolet light, to be 160 mμ to 170 mμ. From the experimentally determined density and sedimentation constants and assuming an approximately spherical shape, Pickels and Smadel[13] calculated the average particle size of the elementary bodies to be 236 mμ to 252 mμ; direct measurements made by Green, Anderson and Smadel[14] from electron photomicrographs of elementary bodies are reported by Smadel and Hoagland[15] only to give values slightly lower than those obtained from ultracentrifugational analysis—no definite figures are given. However, since dehydration, an integral part of the technique of electron microscopy, is reported to decrease the diameter of elementary bodies approximately 14 per cent.,[16] a particle size somewhere around 200 mμ might be expected as compared with the particle size estimated from sedimentation experiments using hydrated elementary bodies.

In size, therefore, the elementary bodies of vaccine virus are close to the smallest bacteria. While pure plant viruses occur as liquid crystals, the elementary bodies of vaccinia morphologically resemble bacteria in structure. Electron microscope examination of the elementary bodies[14] reveals that they have a "bricklike" form within which can be seen five areas of condensation, darker than the surrounding ground substance. The nature of these condensed masses is unknown, as is true of similar masses found in many bacteria. The density of elementary bodies is 1.16,[16] greater than that of bacteria, 1.10[17] and less than that of protein, 1.33.[5] When treated with alkali, the elementary bodies swell and may burst, with resultant extrusion of the internal substance through the break in surface continuity.

None of the smaller animal viruses has been so intensively studied, from the physical standpoint, as vaccine virus, although there is now a perceptible trend to rectify this situation as evidenced by recent publications on rabbit papilloma,[18] mouse encephalomyelitis,[19] poliomyelitis,[20, 21] equine encephalomyelitis[10] and influenza A[22] viruses. The latter virus will be used to illustrate how future work may serve to alter considerably our present conception of individual viruses.

The size of the infectious unit of influenza A virus in infectious mouse lung suspension has been estimated to be 80 mμ to 120 mμ by ultrafiltration[23] and 87 mμ to 99 mμ by centrifugation methods.[24] High-speed centrifugation of such suspensions results in sedimentation of more than 99 per cent. of the infectious material.[22, 25] Electron micrographs show that the sedimented particles have a diameter of approximately 100 mμ,[22] which would be expected from the previous filtration and centrifugation studies. However, when infectious chick embryo allantoic fluid is spun in fields of centrifugal force capable of sedimenting mouse lung virus, infectivity remains about equally distributed between sediment and supernatant,[22] implying that the infectious unit in allantoic fluid actually is much smaller than in mouse lung suspensions. Since centrifugation of infectious and of normal mouse lung suspensions under identical conditions sediments particles of the same size, indistinguishable by electron microscopy or by chemical means,[22] it appears that the infectious unit is considerably smaller than the tissue particles on which it is adsorbed.[22] Bourdillon[26] has found that in infectious mouse lung suspensions only a small proportion of infectivity is associated with particles estimated from their diffusion constant to be about 6 mμ in diameter, while in allantoic fluid, which allows far less opportunity for adsorptive phenomena, up to one half of the infectivity is associated with particles of this size.

---

[11] W. J. Elford and C. H. Andrewes, *Brit. Jour. Exp. Path.*, 13: 36–42, 1932.

[12] W. J. Elford and C. H. Andrewes, *Brit. Jour. Exp. Path.*, 17: 422–430, 1936.

[13] E. G. Pickels and J. E. Smadel, *Jour. Exp. Med.*, 68: 583–606, 1938.

[14] R. H. Green, T. F. Anderson and J. E. Smadel, *Jour. Exp. Med.*, 75: 651–656, 1942.

[15] J. E. Smadel and C. L. Hoagland, *Bact. Rev.*, 6: 79–110, 1942.

[16] J. E. Smadel, E. G. Pickels and T. Shedlovsky, *Jour. Exp. Med.*, 68: 607–627, 1938.

[17] D. Ruffilli, *Biochem. Ztschr.*, 263: 63–74, 1933.

[18] W. R. Bryan and J. W. Beard, *Jour. Nat. Cancer Inst.*, 1: 607–673, 1941.

[19] S. Gard and K. O. Pedersen, SCIENCE, 94: 493–494, 1941.

[20] H. S. Loring and C. E. Schwerdt, *Jour. Exp. Med.*, 75: 395–406, 1942.

[21] E. Racker, SCIENCE, 96: 364–365, 1942.

[22] L. A. Chambers, W. Henle, M. A. Lauffer and T. F. Anderson, *Jour. Exp. Med.*, 77: 265–276, 1943.

[23] W. J. Elford, C. H. Andrewes and F. F. Tang, *Brit. Jour. Exp. Path.*, 17: 51–53, 1936.

[24] W. J. Elford and C. H. Andrewes, *Brit. Jour. Exp. Path.*, 17: 422–430, 1936.

[25] E. H. Lennette and F. L. Horsfall, *Jour. Exp. Med.*, 72: 233–246, 1940.

[26] J. Bourdillon, *Jour. Gen. Physiol.*, 25: 263–273, 1941.

Chambers *et al.*,[22] using infected allantoic fluid, obtained sedimentation constants which correspond to those of spherical particles 10–12.5 mμ in diameter; examination by electron microscopy of the sediments from ultracentrifugation showed a preponderance of spherical particles with a diameter of 11 mμ.

If these findings are substantiated, we must then consider influenza A virus to be one of the smallest known, and group it with the viruses of foot-and-mouth disease[27] and of poliomyelitis.[28, 29] In addition, if its relatively low molecular weight, estimated at 650,000,[22] is confirmed, this would indicate that architectonically influenza A virus is closer to a virus such as tobacco-mosaic than to one like vaccinia or psittacosis, with molecular weights of $4{,}300 \times 10^{-6}$ and $8{,}500 \times 10^{-6}$ respectively.[8b]

The architectural similarity of poliomyelitis virus and of tobacco-mosaic virus perhaps is even closer, since Racker[21] has recently reported the isolation from infected mouse brains of liquid crystals which are protein in nature and which carry the infectivity of the virus.

Chemistry in the Virus

Attempts to study the composition of viruses have been, with few exceptions, restricted to elementary quantitative analyses because of the difficulty in obtaining more than minute amounts of purified material. However, important chemical differences among viruses can be shown only when the integral components, rather than the elements, of which they are built are known.

Of the twenty or so viruses which have been purified, all have been reported to contain nucleic acid. The nucleic acid present in plant virus proteins has invariably been of the ribo- or yeast-nucleic type, and hence the presence of the desoxy-ribose or thymonucleic type in the elementary bodies of vaccine virus[30] might be supposed to constitute a possible difference between viruses of plant and animal origin. Vaccine virus, however, appears to occupy, at least for the present, a unique position among the animal viruses, since the virus proteins of eastern equine encephalomyelitis[10] and of influenza A,[31] admittedly not as highly purified as elementary body suspensions, are reported to be of the yeast-nucleic type; the findings regarding chicken tumor I are contradictory.[32, 33]

Tobacco-mosaic,[34] tobacco ring-spot[34] and rabbit papilloma[18] viruses appear to be composed entirely of nucleic and amino acids, since all the carbohydrate and phosphorus found can be accounted for on the basis of nucleic acid. Other plant viruses, as the latent mosaic virus,[34] may contain in addition a conjugated polysaccharide.

Lipoids have never been found associated with the plant viruses,[34] but the situation with the animal viruses is not clear—eastern equine encephalomyelitis virus appears to contain phospholipids, cholesterol and fatty acids;[10] vaccine virus contains phospholipids, cholesterol and neutral fat;[15] chicken tumor I contains a lipoid fraction of which about two thirds are probably a lecithin and the rest is unidentified,[32] while rabbit papilloma virus consists practically entirely of protein, having a fat content so small that its significance is questionable.[18]

The ability to obtain sufficient amounts of purified plant viruses has made feasible determinations of the amino acids composing the virus protein. Amino acids so far demonstrated in tobacco-mosaic virus protein include arginine, aspartic acid, cysteine, glutamic acid, leucine, lysine, phenylalanine, proline, serine, tryptophane and tyrosine;[35] alanine, histidine and glycine have not been demonstrated.[35] In addition, Stanley and Knight[8b] have been able to show that variations of tobacco-mosaic virus to produce a new strain as shown by serologic tests is also accompanied by specific changes in the amino acid content.

Antigenic Structure

The complexity in antigenic structure of a virus is reflected, within limits, by the number of distinct antibodies it is capable of producing.

The simplest viruses, antigenically, appear to be those of tobacco-mosaic[36] and of rabbit papilloma[37] since only one antibody responsible for both *in vitro* and *in vivo* immune phenomena has been detected. Most of the animal viruses studied thus far, however, give rise to at least two antibodies, one elicited by the virus proper and the other by the so-called soluble antigen, which is distinct and separable from the virus. The virus itself is presumed to give rise to the neutralizing antibodies, which when mixed with the virus *in vitro* render it noninfective. Soluble antigens, on the other hand, call forth antibodies which have no, or slight, neutralizing capacity, but react with the antigens *in vitro* to produce precipitation, agglutination or complement-fixation, depending upon the physical conditions present in the reacting system.

---

[27] I. A. Galloway and W. J. Elford, *Brit. Jour. Exp. Path.*, 12: 407–425, 1931.

[28] Max Theiler and J. H. Bauer, *Jour. Exp. Med.*, 60: 767–772, 1934.

[29] W. J. Elford, I. A. Galloway and J. R. Perdrau, *Jour. Path. and Bact.*, 40: 135–141, 1935.

[30] C. L. Hoagland, G. I. Lavin, J. E. Smadel and T. M. Rivers, *Jour. Exp. Med.*, 72: 139–147, 1940.

[31] L. A. Chambers and W. Henle, *Jour. Exp. Med.*, 77: 251–264, 1943.

[32] A. Claude, Science, 87: 467–468, 1938.

[33] A. Claude, *Proc. Soc. Exp. Biol. and Med.*, 39: 398–403, 1938.

[34] W. M. Stanley, *Physiol. Rev.*, 19: 524–556, 1939.

[35] C. A. Knight and W. M. Stanley, *Jour. Biol. Chem.*, 141: 39–49, 1941.

[36] K. S. Chester, *Phytopathology*, 25: 702–714, 1935.

[37] J. G. Kidd, *Jour. Exp. Med.*, 68: 737–759, 1938.

It appears likely, however, that as adequate techniques are devised additional antigens, complete or partial or both, will be discovered, since there is every reason to believe that the soluble antigen is not a single antigenic entity. Thus, the soluble antigen of infectious myxoma of rabbits has recently been found to contain two components designated A and B[38]—these are easily separable by physical methods, are heat-labile, probably protein in nature and are immunologically distinct. Vaccine virus is even more complex antigenically, since at least five antibodies appear in animals recovered from infection with this virus. Antibodies are produced against a heat-labile (L) and a heat-stable (S) antigen both of which are components of a single substance, LS,[39] shown by Smadel and Shedlovsky[40] to be an elongated protein molecule with a weight of 240,000 and an axis ratio in the neighborhood of 30:1. There is also present a nucleoprotein (NP) antigen[41] which gives rise to an antibody distinct from L and S antibodies, and like the L and S antigens, on injection into animals produces neither immunity to infection nor appreciable amounts of neutralizing antibody. The L, S and NP antigens are believed, according to recent findings, to be located on the surface of the infective unit, the elementary body.[15] Immune sera completely adsorbed with L, S and NP antigens to remove the corresponding antibodies still possess the ability to agglutinate elementary bodies and to neutralize the virus. The antigens responsible for the production of the X-agglutinins[38, 41] and the neutralizing antibody are as yet little known, so that at present it is impossible to say whether they are distinct, related or identical.

DIAGNOSIS

Much has been, and is being done, to develop simple, accurate and inexpensive methods to replace wholly or in part the slow, cumbersome and costly neutralization test, which has been the basic tool in diagnosis and in epidemiologic studies.

Through refinement of the antigens employed and determination of appropriate serum-inactivation temperatures, the specificity of the complement-fixation test has been brought to the stage where it is now possible to distinguish between experimental infections induced by the viruses of rabies, eastern and western equine encephalomyelitis, lymphocytic choriomeningitis, louping ill, St. Louis encephalitis and Japanese B encephalitis.[42] Preliminary experiences with the test in the diagnosis of human infections with some of these viruses are highly encouraging.[42, 43]

With a few notable exceptions, attempts to demonstrate precipitation in specific animal virus antigen-antibody systems have been almost consistently negative. Recently, however, this field has been reopened with the finding that it is possible, at least in some cases, to demonstrate specific antigen-antibody union by the addition of an "indicator system" composed of bacteria[44] or of finely dispersed particles of collodion[45] whose aggregation leads to the formation of visible floccules.

Hirst[46] has observed that chick red cells are agglutinated in the presence of influenza virus and that agglutination can be prevented by immune serum. On the basis of these observations he has devised a method for titrating the agglutination-inhibiting substance in influenza immune sera[47, 48] and has been able to show that it closely parallels the neutralizing antibody titer. The full implications of Hirst's findings are still unknown, but a similar technique has already been found applicable to vaccine virus infections.[49] The simplicity of the technique and the rapidity and ease with which a large number of sera can be examined have provided a valuable method for diagnosis and especially for epidemiologic investigations of those viral diseases to which it may be found applicable.

EPIDEMIOLOGY AND EPIZOOTIOLOGY

Within the last few years our conception of the epidemiology and pathogenesis of poliomyelitis has been considerably altered. This disease was generally believed to be spread solely, or almost so, by droplet infection, the virus gaining access to the central nervous system from the nasal mucous membrane by ascent along the olfactory nerve. Recent reinvestigation, in rather minute detail, of the pathogenesis and the pathology of poliomyelitis has brought forth considerable evidence that the alimentary tract is the usual portal of entry for the virus (reviewed in[50, 51, 52]).

---

[38] J. E. Smadel, S. M. Ward and T. M. Rivers, *Jour. Exp. Med.*, 72: 129–138, 1940.

[39] a. J. Craigie and F. O. Wishart, *Jour. Exp. Med.*, 64: 819–830, 1936. b. T. Shedlovsky and J. E. Smadel, *Jour. Exp. Med.*, 75: 165–178, 1942.

[40] J. E. Smadel and T. Shedlovsky, *Annals New York Acad. Sci.*, 43: 35–46, 1942.

[41] J. E. Smadel, T. M. Rivers and C. L. Hoagland, *Arch. Path.*, 34: 275–285, 1942.

[42] J. Casals and R. Palacios, *Jour. Exp. Med.*, 74: 409–426, 1941.

[43] J. Casals, *Am. Jour. Pub. Health*, 31: 1281–1284, 1941.

[44] E. C. Roberts and L. R. Jones, *Proc. Soc. Exp. Biol. and Med.*, 49: 52–54, 1942; *ibid.*, 47: 75–76, 1941.

[45] K. Goodner, SCIENCE, 94: 241–242, 1941.

[46] G. K. Hirst, SCIENCE, 94: 22–23, 1941.

[47] G. K. Hirst, *Jour. Exp. Med.*, 75: 49–64, 1942.

[48] G. K. Hirst and E. G. Pickels, *Jour. Immunol.*, 45: 273–283, 1942.

[49] F. P. O. Nagler, *Med. Jour. Australia*, 1: 281–283, 1942.

[50] A. B. Sabin, *Jour. Am. Med. Asn.*, 117: 267–269, 1941.

[51] E. W. Schultz, *Jour. Pediat.*, 20: 110–124, 1942.

While it is possible that the virus can multiply throughout the alimentary tract, the pharynx and small intestine appear to provide the sites of choice. The virus is believed to migrate from these areas to the central nervous system via two main routes.[52] The first, which gives rise to a preponderance of bulbar symptoms, is along the cranial nerves or the parasympathetic system into the medulla; the other, which results in paralysis of the extremities, is along the visceral afferent or efferent fibers of the intestine, through the corresponding spinal or abdominal sympathetic ganglia, into the spinal cord. The total inability to demonstrate a centrifugal spread of the virus from the central nervous system is interpreted to mean that the virus multiplies in, and is eliminated from, the alimentary tract. The persistence of the virus in the stools of convalescents,[53] its presence in the stools of healthy contacts,[53] the spread of the disease by healthy carriers[54] and perhaps by flies,[55] the occurrence of cases throughout the year with a peak incidence during the summer and early fall months all point to an epidemiologic picture typical of gastro-intestinal rather than respiratory routes of infection.

The comprehensive studies of Howitt[56] have demonstrated that the viruses of western equine encephalomyelitis and of St. Louis encephalitis are endemic in central California. Hammon[57] has shown that epidemics due to both viruses can occur simultaneously and that human cases due to a mixed infection probably do occur. Both Howitt and Hammon and their associates have found that the sera of certain birds and mammals in the affected areas contain neutralizing antibodies to one or both of these viruses, a finding which not only points to a possible mechanism for widespread dissemination of the virus but also implies that an arthropod vector may be involved in transmission. Further, the complete lack of epidemiologic evidence that these viruses are carried through food or water or that infections arise through direct or indirect contact, as well as the limitation of these diseases to the warm months of the year are in accord with such a view. While *Triatoma sanguisuga* Leconte has been found[58] naturally infected with the western equine virus, its distribution does not coincide with that of the virus[59a] and it is believed by Hammon and his associates not to be an efficient vector.[59a] In a search for vectors possibly associated with the Yakima Valley outbreak of encephalitis Hammon *et al.*[60] isolated five strains of the western equine virus and three of the St. Louis virus—all from a single species of mosquito, *Culex tarsalis* Coquillet. This is the first instance of isolation of the St. Louis virus from any material other than human tissues, and the first time either virus has been found in a wild-caught mosquito. Since it does not necessarily follow that an arthropod infected with virus can transmit it, proof of ability to transmit must be obtained under experimental conditions. *C. tarsalis* was quickly proved capable of transmitting the St. Louis virus experimentally[59a] and *C. pipiens*, *C. coronator*, *Aedes lateralis*, *A. taeniorhynchus*, *A. vexans* and *Theobaldia incidens* have just been added[59b] as potential vectors. The western equine virus has been transmitted under experimental conditions by *C. tarsalis* and also by *Theobaldia incidens*.[59b]

We may find eventually that other arthropods can participate in the transmission of western equine encephalitis and St. Louis encephalitis since, under laboratory conditions, many Aedes as well as *Dermacentor andersoni* can transmit the western equine virus and *Dermacentor variabilis* can transmit the St. Louis virus (reviewed in[59a]).

One of the great riddles of epidemiology is what happens to a virus during interepidemic periods, when it apparently disappears, and what influences a virus to flare up suddenly from its quiescent state. A step toward the solution of this riddle is afforded by the important discovery of Shope[61] that the virus of swine influenza is capable of existence in a masked noninfectious form from which it can be provoked into activity by appropriate stimuli. Thus, in a swine with active influenza infection, the virus is taken up by lungworms (*Metastrongylus elongatus* and *Choerostrongylus pudendo-tectus*) in the lung. Embryonated ova are passed in the feces and eventually are ingested by an earthworm, which is the intermediate host of the lungworm. In the earthworm the ova pass through developmental cycles until the third larval stage, infective for pigs, is reached. Ingestion of infected earthworms by swine leads to liberation of the larvae which make their way to the lungs and develop into adults. The virus continues to remain in its noninfective form until it is activated by a "provoking stimulus," such as repeated injections of *H. influenzae* or of calcium chloride, when the disease supervenes. What causes fully active swine influenza virus to become noninfective when taken up by the lungworm and to resume its infectivity when it again finds itself within a susceptible swine is still unknown. Shope has shown that the virus is able to survive for at least two years in its noninfective form in the lungworm, which indicates that the virus possesses an excellent means of ensuring its survival between epizootics.

---

[52] A. B. Sabin, *Jour. Am. Med. Asn.*, 120: 506–511, 1942.

[53] a. S. D. Kramer, A. G. Gilliam and J. G. Molner, *Pub. Health Rep.*, 54: 1914–1922, 1939. b. S. D. Kramer, B. Hoskwith and L. H. Grossman, *Jour. Exp. Med.*, 69: 49–67, 1939. c. J. D. Trask, J. R. Paul and A. J. Vignec, *Jour. Exp. Med.*, 71: 751–763, 1940. d. H. A. Howe and D. Bodian, *Jour. Infect. Dis.*, 66: 198–201, 1940.

[54] E. A. Piszczek, H. J. Shaughnessy, J. Zichis and S. O. Levinson, *Jour. Am. Med. Asn.*, 117: 1962–1965, 1941.

[55] A. B. Sabin and R. Ward, SCIENCE, 94: 590–591, 1941; *ibid.*, 95: 300–301, 1942.

[56] a. B. F. Howitt, *Proc. Sixth Pacific Sci. Cong.*, 5: 235–245, 1942; b. B. F. Howitt and W. Van Herick, *Jour. Infect. Dis.*, 71: 179–191, 1942.

[57] W. M. Hammon, *Jour. Am. Med. Asn.*, 117: 161–167, 1941.

[58] C. H. Kitselman and A. W. Grundman, *Kansas Agric. Exp. Sta. Tech. Bull.* No. 50, p. 1–15, 1940.

[59] a. W. M. Hammon, W. C. Reeves, B. Brookman and C. M. Gjullin, *Jour. Infect. Dis.*, 70: 278–288, 1942. b. W. M. Hammon, W. C. Reeves and M. Gray, *Am. Jour. Pub. Health*, 33: 201–207, 1943.

[60] W. M. Hammon, W. C. Reeves, B. Brookman and E. M. Izumi, *Jour. Infect. Dis.*, 70: 263–266, 1942.

[61] R. E. Shope, *Jour. Exp. Med.*, 74: 41–47, 1941.

PROPHYLAXIS AND THERAPY

An effective and relatively safe method of vaccination against yellow fever has been available since 1937[62a] when a strain (17D) of virus with attenuated virulence was obtained after prolonged tissue-culture passage of the classic Asibi strain. The vaccine, prepared from chick-embryo tissue infected with the 17D strain, has been used in endemic areas of yellow fever on such a huge scale and with such good results that its protective powers are undoubted (literature in[62b]).

Vaccines have also been developed against the eastern and western equine encephalomyelitis viruses, but in this case the high virulence of the viruses has required their inactivation with formol.[63] Their protective action in animals has been shown to be of a high order, and hence they probably exert a similar effect in man—at least no cases of the disease have occurred in vaccinated laboratory workers.[63]

Encouraging results are reported, in preliminary trials, with vaccination against the tick-borne Russian spring-summer encephalitis.[64] Formol-inactivated mouse brain virus suspensions were administered to 925 individuals in an endemic area. Two cases occurred in the vaccinated group and twenty-seven in the control group of 1,185 nonvaccinated individuals, ratios of 1 in 462 and 1 in 44, respectively.

The efficacy of vaccines against influenza A is still unknown and must await further trial under controlled conditions. A recent analysis by Horsfall[65] of five independent studies of the complex influenza A vaccine[66] showed that the reduction in incidence of the disease among vaccinated persons varied from 47 per cent. to practically nil, and that on the average the number of cases in the vaccinated group was about two thirds that of the unvaccinated group. In addition any increased resistance induced by vaccination seems to be of short duration.[67] Inhalations of immune serum have been reported to exert a protective action both in prophylaxis[68] and in therapy.[69]

The results of attempts at sulfonamide therapy in virus diseases have been disappointing. This is not surprising, however, since the presence of sulfonamides in tissue culture has been found to have no appreciable effect on the multiplication of any of the viruses cultivated in such an environment.[70, 71] Of the diseases usually classed with those of virus origin, only four—trachoma, inclusion blenorrhea, lymphogranuloma venereum and mouse pneumonitis—are known to respond to sulfonamide therapy.[72] Rake, Jones and Nigg,[73] however, do not believe that the success in therapy in these four diseases has any bearing on the chemotherapy of the "true" virus disease, since there is increasing evidence[73, 74] that the causative agents of the lymphogranuloma venereum-psittacosis group of diseases—to which these four belong[72]—should be separated from the true viruses.

NEW VIRUSES

New viruses and diseases caused by them continue to be uncovered. In 1938 a virus responsible for the Russian spring-summer type of encephalitis was recovered from the brains of fatal human cases by Levkovitsch, Shubladze, Chumakov and Soloviev.[75, 76] The virus is transmitted to man by ticks (*Ixodes persulcatus*) and is reported[76] to be related immunologically to the virus of Japanese B, or summer, encephalitis, which is mosquito transmitted. Animals immune to the Russian spring-summer encephalitis virus are resistant to inoculation of the Japanese B virus and their sera neutralize completely the Japanese virus, but in the reverse direction only partial protection or neutralization occurs, which indicates that antigenically the Russian spring-summer encephalitis virus is more complex than the Japanese virus. Casals and

---

[62] a. M. Theiler and H. H. Smith, *Jour. Exp. Med.*, 65: 767–786, 1937. b. J. P. Fox and A. S. Cabral, *Am. Jour. Hyg.*, 37: 93–120, 1943.

[63] D. W. Beard, H. Finkelstein and J. W. Beard, *Jour. Immunol.*, 40: 497–507, 1941.

[64] A. A. Smorodintseff, N. W. Kagan, E. N. Levkovitsch and N. L. Dankovskij, *Arch. ges. Virusforsch.*, 2: 1–25, 1941.

[65] F. L. Horsfall, Jr., *Jour. Am. Med. Asn.*, 120: 284–287, 1942.

[66] F. L. Horsfall and E. H. Lennette, SCIENCE, 91: 492–494, 1940.

[67] G. K. Hirst, E. R. Rickard, L. Whitman and F. L. Horsfall, Jr., *Jour. Exp. Med.*, 75: 495–511, 1942.

[68] R. M. Taylor, *Jour. Immunol.*, 41: 453–462, 1941.

[69] A. A. Smorodintseff, *Proc. Third Int. Cong. Microbiol.*, New York, September 2–9, 1939, p. 375 (abstract).

[70] M. Sanders, C. H. Huang and H. S. Simms, *Jour. Bact.*, 45: 81–82, 1943 (abstract).

[71] H. Koprowski and E. H. Lennette, *Am. Jour. Hyg.*

[72] G. Rake, M. F. Shaffer and P. Thygeson, *Proc. Soc. Exp. Biol. and Med.*, 49: 545–547, 1942.

[73] G. Rake, H. P. Jones and C. Nigg, *Proc. Soc. Exp. Biol. and Med.*, 49: 449–452, 1942.

[74] M. D. Eaton, W. P. Martin and M. D. Beck, *Jour. Exp. Med.*, 75: 21–33, 1942.

[75] E. N. Levkovitsch, A. K. Shubladze, M. P. Chumakov and V. D. Soloviev, *Arch. Sc. Biol.*, 52: 162–163, 1938.

[76] A. A. Smorodintseff, *Arch. ges. Virusforsch.*, 1: 468–480, 1940.

Webster[77] have reported that preliminary cross-fixation and cross-immunity tests indicate the Russian spring-summer virus to be very closely related to, if not identical with, louping-ill virus which, also transmitted by ixodid ticks, is the cause of an encephalitis in sheep in Scotland and may have been responsible for an outbreak of human encephalomyelitis (X-disease) in Australia in 1917–18.[78] If the close relationship of the Russian spring-summer encephalitis and louping-ill viruses is substantiated, one might speculate as to whether the Japanese B virus may not represent a variant of these viruses arising from prolonged association with another arthropod vector. As a matter of fact, the virus causing the Russian autumn encephalitis has been identified as that of Japanese B encephalitis, and has been recovered from naturally infected *Culex pipiens* and *C. tritaeniorhynchus*.[79]

Isolation of the West Nile virus was reported in 1940 by Smithburn, Hughes, Burke and Paul.[80] The name derives from the locality (West Nile district, Northern Province of Uganda) from which the blood specimen containing the virus was furnished, and as the specimen was taken during the course of a routine sleeping sickness survey, nothing is known of the pathologic activity of this virus in man. It has, however, some relationship to the viruses producing encephalitides in man, since it is neutralized by immune sera to both the St. Louis and Japanese B viruses, although its corresponding immune sera lack any demonstrable capacity to neutralize these viruses.[81]

Smithburn, Mahaffy and Paul[82] in 1941 reported the isolation on different occasions of a virus associated with an illness whose only features were abrupt onset, fever and severe headache and backache—the disease has been named Bwamba fever after the county in the Western Province of Uganda where it occurred.

In a number of outbreaks of undoubted influenza it proved difficult or impossible to demonstrate that the etiologic agent was the classic influenza virus, now known as influenza A virus.[83] An explanation in part was provided in 1940 when Magill[84] and Francis[85] independently and almost simultaneously announced the isolation of a second influenza virus, now designated influenza B.[83, 85] While these viruses are completely distinct immunologically, the infections they produce can not be distinguished clinically one from another. Since these viruses, alone or together, fail to account for a considerable number of cases, depending on the epidemic, it is reasonable to assume the existence of additional influenza viruses as yet unrecognized.[86]

During the last few years there has been observed with increasing frequency a respiratory disease known by several names but usually referred to as atypical pneumonia (reviewed in [87]). A number of viral agents whose association with the disease is sometimes difficult to assess and whose relationship to each other is still indeterminate, have been isolated.[88] Of these agents the best known and most completely studied is the virus isolated by Eaton, Beck and Pearson[88c] in 1940 and called meningopneumonitis virus because of its close antigenic similarity to the meningopneumonitis virus isolated in 1938 by Francis and Magill[89] from ferrets inoculated with human throat washings and believed by them to have been present in their normal ferret stock. Recently acquired evidence[88c, 90] shows that the viruses of meningopneumonitis, lymphogranuloma venereum and psittacosis are related antigenically, and in addition are characterized by the formation of elementary bodies with similar tinctorial properties and by their ability to produce meningitis, pneumonia and granulomata in the skin of suitable test animals. So similar are these viruses in their properties that it appears not improbable that they are derived from a common progenitor and that by adaptation to different tissues and animal species they have acquired certain characteristics peculiar to themselves. Eaton *et al.*[88e] have recently isolated another virus-like agent from cases of atypical pneumonia and it will be interesting to know whether the new agent will fall into the lymphogranuloma venereum-psittacosis group.

During the summer of 1941 there occurred in Oahu,

---

[77] J. Casals and L. T. Webster, SCIENCE, 97: 246–248, 1943.

[78] a. F. M. Burnet, *Med. Jour. Australia*, 1: 679–681, 1934. b. J. R. Perdrau, *Jour. Path. and Bact.*, 42: 59–65, 1936.

[79] A. A. Smorodintseff, A. K. Shubladse and V. D. Neustroev, *Arch. ges. Virusforsch.*, 1: 549–559, 1940.

[80] K. C. Smithburn, T. P. Hughes, A. W. Burke and J. H. Paul, *Am. Jour. Trop. Med.*, 20: 471–492, 1940.

[81] K. C. Smithburn, *Jour. Immunol.*, 44: 25–31, 1942.

[82] K. C. Smithburn, A. F. Mahaffy and J. H. Paul, *Am. Jour. Trop. Med.*, 21: 75–90, 1941.

[83] F. L. Horsfall, Jr., E. H. Lennette, E. R. Rickard, C. H. Andrewes, Wilson Smith and C. H. Stuart-Harris, *Lancet*, 2: 413, 1940.

[84] T. P. Magill, *Proc. Soc. Exp. Biol. and Med.*, 45: 162–164, 1940.

[85] T. Francis, Jr., SCIENCE, 92: 405, 1940.

[86] E. H. Lennette, E. R. Rickard, G. K. Hirst and F. L. Horsfall, Jr., *Pub. Health Rep.*, 56: 1777–1788, 1941.

[87] J. H. Dingle and M. Finland, *New England Jour. Med.*, 227: 378–385, 1942.

[88] a. J. Stokes, Jr., A. S. Kenney and D. R. Shaw, *Tr. & Stud. College Physicians, Philadelphia*, 6: 329–333, 1939. b. J. M. Weir and F. L. Horsfall, Jr., *Jour. Exp. Med.*, 72: 595–610, 1940. c. M. D. Eaton, M. D. Beck and H. E. Pearson, *Jour. Exp. Med.*, 73: 641–654, 1941. d. J. A. Baker, SCIENCE, 96: 475–476, 1942. e. M. D. Eaton, G. Meiklejohn, W. Van Herick and J. C. Talbot, SCIENCE, 96: 518–519, 1942.

[89] Thomas Francis, Jr. and T. P. Magill, *Jour. Exp. Med.*, 68: 147–163, 1938.

[90] M. D. Eaton, W. P. Martin and M. D. Beck, *Jour. Exp. Med.*, 75: 21–33, 1942.

Hawaii, a large outbreak of a highly contagious, acute type of conjunctivitis.[91] By September the epidemic, which is thought to have had its origin in Malaya,[92] had spread to the Pacific Coast of the United States, where it involved chiefly shipyard workers. In the late summer and early fall of 1942 outbreaks of the disease occurred in New York, Schenectady and Hartford.[92] From cases in the New York outbreak of the disease, now designated epidemic keratoconjunctivitis, Sanders and Alexander[93] were able on two occasions to isolate in tissue culture a virus which has proved to be pathogenic for man and for mice and rabbits. The association of their virus with the human disease appears to be established, although further work is desirable and doubtless will be forthcoming.

In conclusion, it should be emphasized that this presentation has of necessity been limited in scope and that many interesting and important contributions to our knowledge of viruses have had, perforce, to be omitted. So intensively and so sedulously have viruses and the diseases due to them been studied in recent years that any attempt, such as this, to summarize briefly the recent advances in this field, can do no more than present the high lights.

OBITUARY

FELIX AGUILAR

The director of the Astronomical Observatory of the University of La Plata, Dr. Félix Aguilar, died suddenly on September 28, 1943. Mr. Aguilar was not only one of the leading astronomers of the Republic of Argentina, but he was also active as president of the Comisión para la Medición de un arco de meridiano en la República Argentina, president of the Comisión Nacional de Observatorios and member of the Comisión de límites Argentino-Chilena. He served as professor of geodesy in the University of La Plata and was a member of several scientific associations such as the Sociedad Científica Argentina and the Academia Nacional de Ciencias. At the La Plata Observatory his name was connected with the creation of the Escuela Superior de Ciencias Astronómicas y Conexas and with the Instituto Geográfico Militar, where he served as head of the geodesy department. He was active in the determination of the difference in longitude between Potsdam and Belgrano (Buenos Aires), and participated in the first gravimetrical and magnetic investigations of the Instituto Geográfico. In 1936 he was placed in charge of the reorganization of the Observatorio Astronómico Nacional at Córdoba. He was the author of many scientific papers and invented a method for the use of calculating machines in the determination of latitude by a method of Gauss. He undertook one of the few astronomical leveling operations that have ever been executed. A short time before his death he arranged for two of his associates, Dr. Carlos Cesco and Dr. Jorge Sahade, to come to the United States for research in astrophysics.

Otto Struve

DEATHS AND MEMORIALS

Dr. Alexander G. McAdie, from 1913 to 1931 professor of meteorology at Harvard University and for eighteen years director of the Blue Hill Observatory, died on November 1 at the age of eighty years.

Dr. Henry Vinecome Arny, who retired in 1937 as dean of the College of Pharmacy of Columbia University, died on November 3. He was seventy-five years old. Dr. Arny had served as professor of chemistry at the College of Pharmacy from 1911 to 1937 and as dean of the college from 1930 to 1937.

Dr. Glenn Warren Goldsmith, since 1929 professor of botany and bacteriology at the University of Texas, died on October 28. He was fifty-six years old.

Dr. Ira Edwards, curator in geology of the Milwaukee Museum, died on October 31 at the age of fifty years.

Charles A. Donnel, a former head of the Office of the U. S. Weather Bureau in Chicago, principal meteorologist and supervising forecaster for the district, died on October 29. He was sixty-two years old.

A correspondent writes: Dr. Wilmon Newell, provost for agriculture at the University of Florida, director of the Agricultural Experiment Station and Extension Service, and plant commissioner, State Plant Board, as already reported in Science, died on October 25 at the age of sixty-five years. After serving as entomologist in Iowa, Ohio, Texas, Georgia and Louisiana, he accepted the position of plant commissioner in 1915 with the newly created State Plant Board and directed the campaign which eradicated citrus canker in Florida. In 1929 he directed a similar campaign for the eradication of the Mediterranean fruit-fly; this work was completed in 1930. He was director of the Florida Agricultural Experiment Station and Extension Service from 1921 to date, dean of the College of Agriculture from 1921 to 1938 and provost for agriculture since 1938.

---

[91] Editorial, *Jour. Am. Med. Asn.*, 118: 460, 1942.

[92] J. H. Dunnington, *Symposium on Epidemic Keratoconjunctivitis* held at the College of Physicians and Surgeons, Columbia University, School of Medicine, under the direction of the Division of Preventive Medicine, Office of the Surgeon General, Department of War, and in conjunction with the Commission on Neurotropic Virus Diseases, Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army, December 4, 1942.

[93] M. Sanders and R. C. Alexander, *Jour. Exp. Med.*, 77: 71–95, 1943.

MEMORIAL exercises in honor of the late Dr. Frank Schlesinger, professor of astronomy and director of Yale University Observatory, emeritus, who died on July 10, will be held in Strathcona Hall, Yale University, on Friday, November 19, at 4:30 P.M. The speakers will be Dr. James Rowland Angell, president emeritus of Yale University, and Professor Henry Norris Russell, of Princeton University. President Charles Seymour, of Yale University, will preside.

A PERMANENT memorial to William Beaumont, known as the founder of our modern knowledge of the physiology of the stomach, has been assured by the transfer of the historical "Early House" on Mackinac Island to public ownership.

SCIENTIFIC EVENTS

GIFTS TO THE ROYAL COLLEGE OF SURGEONS, ENGLAND

AN immediate gift of £100,000 for the endowment of the department of pathology and the institution of a chair of human and comparative pathology to the Royal College of Surgeons of England by W. H. Collins, of Buckinghamshire, is reported in *The Times*, London.

Mr. Collins has also informed the college that he has made provision in his will for a bequest of a further £100,000 for the endowment of the department of anatomy and the institution of a chair of human and comparative anatomy.

Sir Alfred Webb-Johnson, who presided at a meeting of the council of the college, when the gifts were announced on October 14, read a letter from Mr. Collins, in which he said:

> Throughout my career I have realized how essential is the study and investigation of basic problems. Success of armies in the field is dependent on careful planning and preparation at headquarters, and victories in the war against disease can only be achieved by due application and increased knowledge of the fundamental medical sciences.
>
> I have been greatly impressed with the value of the departments of anatomy and pathology, which have made the Royal College of Surgeons of England famous all over the world. I have seen what grievous injury your departments have suffered as the result of enemy action, and appreciate what a gigantic task it will be to restore them to their unique position in the scientific world. To embark upon this task it is essential that the departments shall have an assured income from endowments. . . . I trust that my gifts will enable the council to proceed with confidence with their responsible task and to engage the services of men of outstanding ability to assist them in their labors.

It is recalled in *The Times* that the Royal College of Surgeons was badly damaged in the air raids in 1941 and that most of the Hunterian collection was lost when the museum of the college, situated in Lincoln's Inn Fields, was wrecked by a high-explosive bomb. The museum was unique and the Hunterian collection was the proudest possession of the college.

REPORT OF THE COMMITTEE ON THE PROFESSIONAL TRAINING OF CHEMISTS

THE Committee on the Professional Training of Chemists, according to *Chemical and Engineering News*, has had inquiries as to the minimum time required for a student in chemistry to complete his professional training in an accelerated program—especially as to whether it would be possible to complete the requirements of the society in two calendar years. The maximum time now allowed by Selective Service for deferment of students of chemistry and of other fields of technology is twenty-four months. It is the opinion of the committee that the present requirements can not be met in less than two and two-thirds calendar years, which would include eight semesters in an accelerated tri-semester schedule.

At present freshman and sophomore students become eighteen years of age before they are within twenty-four months of graduation and can not be deferred. The stream of technical students is therefore drying up at the source. Already the enrolment is down to about one third of normal. Unless some provision is made for a longer period of deferment for chemists and engineers, within one or two more years there will be no fully trained graduates in these technical fields.

It is further the opinion of the committee that students who take the Army specialist training courses in chemical engineering or other essential fields should return to college later to complete the standard requirements in order to prepare themselves to be permanently useful in industry or to go on in advanced training.

W. A. NOYES, JR., *Chairman*
E. M. BILLINGS
S. C. LIND
H. B. WEISER
W. G. YOUNG

THE DYSENTERY REGISTRY

The present military situation and the general increasing interest in bacillary dysentery has resulted in many inquiries concerning the work of the Dysentery Registry. The organization was founded in 1933 for the prevention and study of bacillary dysentery. It was found that when cases of infectious diarrhea as a whole were carefully studied, most of them appeared to be bacillary dysentery. Greater interest in the recognition of bacillary dysentery and an actual rising incidence of the disease in the United States resulted in a forty-fold increase in the number of reported cases between the years 1933 and 1941. Major advances in bacillary dysentery have occurred during this period. A seven-point program for the control of the disease was formulated in 1933 and was largely responsible for the compulsory reporting of bacillary dysentery in all states by 1940 (it had not been a reportable disease in 15 states in 1937).

As part of the educational program, a film entitled "Hand to Mouth" (800 feet, 16 mm silent) was produced for the New York World's Fair. Since then copies of the film have been loaned, without cost, to public health and educational agencies throughout the United States and South America. Others have been purchased at actual cost by the American Medical Association and many of our state and city health departments. A permanent copy is on file at the Wistar Institute.[1]

The registry has received the cooperation of government officials throughout the world, and has, in turn, given freely of its accumulated knowledge and resources.

Since the outbreak of the second world war, the work of the Dysentery Registry in furnishing strains or diagnostic sera and in the identification of atypical organisms for public health and military laboratories has greatly increased. Preliminary tests during the past two months indicate the wide applicability in the United States of the Boyd strains and of the new classification of the dysentery group of organisms.

Regional branches of the registry are now in process of formation throughout the world, chiefly at universities and departments of health. The present membership roster includes most of the prominent investigators in the field, chiefly associated with universities and government public health agencies. The central registry has been supported by the Bronx Hospital and by the voluntary contributions of friends of the registry (Blood Betterment Association, Schonbrunn and Golding Funds). Although available funds are very limited, economical management has made possible the rendering of all services without cost to those who seek them. There is every reasonable expectation that the problem of bacillary dysentery and the other infectious diarrheas will increase during the war and post-war periods.

Joseph Felsen, M.D.,
Director, Dysentery Registry

The Bronx Hospital,
New York, N. Y.

RARE CHEMICALS

The following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

p-Aminophenylalanine
Berberine hydrochloride
Decamethylenediguanidine
Ergothionine
Iodoacetic acid (large quantities)
Laevo butandiol-2,3
Methyl silican chlorides (CH_3) Si Cl_3 or $(Ch_3)_2$ Si Cl_2
Nickel tetra carbonyl
Pseudo-ionone
Piperonylidine acetophenone
Sodium sulfadiazine
Trimethyl sulphine hydroxide $(CH_3)_3$ S–OH
Thiolhistidine
2-Thioparabanic acid
Vinyl ethyl ether
Vinyl stearate
Xanthopterin

PROGRAM OF THE LANCASTER BRANCH OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The Lancaster Branch of the American Association, which has approximately a thousand members, has announced the following lecturers with their subjects for the season 1943 to 1944:

November 11, Dr. David Sarnoff, president of the Radio Corporation of America, "Industrial Science Looks Ahead."

December 9, The Rev. Bernard R. Hubbard, S.J., geologist at Santa Clara University and well-known lecturer, "The Aleutian Battleground."

January 13, Albert Q. Maisel, war correspondent, "Miracles of Military Medicine."

February 17, Dr. Kirtley F. Mather, professor of geology at Harvard University, "Natural Resources and World Organization."

March 30, Larry F. Livingston, manager of the Agricultural Extension Division of the E. I. du Pont de Nemours and Company, "Yesterday, To-day and Tomorrow."

Officers of the branch are: Jaques Cattell, *Chairman;* Dr. C. C. Vogt, *Vice-chairman;* Dr. Frances A. Coventry, *Secretary,* and Professor H. M. Fry, *Treasurer.*

---

[1] Reviews of Approved Films in Anatomy and Biology, *Anatomical Record.*

THE PACIFIC DIVISION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

AT the meeting of the executive committee of the Pacific Division of the American Association for the Advancement of Science, held on October 15, it was agreed that meetings of the division be suspended for the duration of the war. The secretary was instructed to notify all affiliated and associated societies to this effect and to offer the services of his office in facilitating the arrangements of small regional meetings by individual societies or by such groups of societies as may desire to hold meetings. The action of the executive committee resulted from a poll of member societies and from consideration of the increasing difficulties in transportation and housing which render difficult the holding of scientific meetings of any appreciable size.

In order to maintain the necessary contacts with member societies and to facilitate the initiation of meetings at the end of this emergency, Dr. J. Murray Luck, professor of biochemistry at Stanford University, secretary of the division, should be advised of any changes in secretaryship that may occur in affiliated and associated societies.

THE AMERICAN PHILOSOPHICAL SOCIETY

THE autumn general meeting of the American Philosophical Society, Philadelphia, will be held on November 19 and 20. The following program has been arranged:

FRIDAY MORNING, NOVEMBER 19

Open Session, 10 o'clock

Edwin G. Conklin, president, in the chair.

Victor F. Hess,[1] professor of physics, Fordham University, "A Study of the Ionization of the Atmosphere by Cosmic and Local Radiation." (Lantern slides.)

William H. Hobbs,[1] professor emeritus of geology, University of Michigan, "The Scablands Glacial Lobe in Eastern Washington." (Lantern slides.)

Albert F. Blakeslee,[1] director, Genetics Experiment Station, Smith College, and Sophie Satina, "New Hybrids from Incompatible Crosses in Datura through Culture of Excised Embryos on Malt Media." (Lantern slides.)

John E. Weaver,[1] professor of plant ecology, University of Nebraska, "Recovery of Midwestern Prairies from Drought." (Lantern slides.) (To be read by Elmer D. Merrill.)

Charles B. Davenport, research associate (ret.), Carnegie Institution of Washington, "Periodicity in Growth of Long Bones." (Lantern slides.)

Alexander Sandow,[1] assistant professor of biology, Washington Square College of Arts and Science, "Latency-Relaxation and Mechano-Chemical Coupling in Muscular Contraction." (Lantern slides.)

Carl C. Speidel,[1] professor of anatomy, University of Virginia, "A Cine-Photomicrographic Study of the Activities of Lymph Vessels and Macrophages in the Disposal of Extravasated Red Blood Cells." (Lantern slides and moving pictures.)

John H. Storer,[1] Waltham, Mass., "Study of the Soaring Technique of the California Condor." (Lantern slides and moving pictures.)

Luncheon for members and invited guests, 1 o'clock.

FRIDAY AFTERNOON

Open Session, 2 o'clock

Symposium on the Organization, Direction and Support of Research

George Howard Parker in the chair.

Hugh S. Taylor, David B. Jones professor of chemistry, Princeton University, "Research in the Physical Sciences."

Detlev W. Bronk, professor of biophysics, director, Eldridge Reeves Johnson Foundation for Medical Physics, University of Pennsylvania, "The Discovery and Interpretation of Biological Phenomena."

Alan Gregg, director for the Medical Sciences, Rockefeller Foundation for Medical Research, "Medical Research."

Open Discussion

To be led by Karl K. Darrow, research physicist, Bell Telephone Laboratories.

FRIDAY EVENING, 8:30 O'CLOCK

Edwin G. Conklin, president, in the chair.

Franklin Medal Lecture

James B. Conant, president, Harvard University, "The Advancement of Learning in the United States in the Post-War World." The lecture will be followed by a reception.

SATURDAY MORNING, NOVEMBER 20

Open Session, 10:30 o'clock

Edward P. Cheyney, vice-president, in the chair.

Harold A. Innis, professor of political economy, University of Toronto, "Political Economy in the Modern State."

Robert Livingston Schuyler, Gouverneur Morris professor of history, Columbia University, "War and Historiography."

Marjorie Hope Nicolson, professor of English, Columbia University, "Merchants of Light: Research in Arts and Letters."

Open Discussion

To be led by Roy F. Nichols, professor of history, University of Pennsylvania.

Luncheon for Members and Invited Guests, 1 o'clock.

SATURDAY AFTERNOON

Open Session, 2 o'clock

W. F. G. Swann, secretary, in the chair.

William Berryman Scott,[1] professor emeritus of geology, Princeton University, "Vertebrate Fossils of the Duchesne River Beds."

Edwin Walter Kemmerer, professor emeritus of international finance, Princeton University, "The International Character of Economics."

---

[1] Recipient of grant from the Research Funds.

Lloyd R. Watson,[1] professor of chemistry, Alfred University, "Economic Aspects of Controlled Mating of Honeybees."

Charles R. Anderson,[1] associate professor of American literature, the Johns Hopkins University, "The Centennial Edition of Sidney Lanier."

Charles de Tolnay,[1] Institute for Advanced Study, "Theory of Drawing in Italy and France During the Renaissance and Baroque."

THE CHARLES L. MAYER AWARD OF THE NATIONAL ACADEMY OF SCIENCES

MANUSCRIPTS and published articles submitted for the 1943 Charles L. Mayer Prize are being received by the National Science Fund of the National Academy of Sciences, 515 Madison Ave., New York 22, N. Y. The closing date for the receipt of contributions is January 15, 1944.

The award will be made for an outstanding contribution to present-day knowledge of factors affecting the growth of animal cells with particular reference to human cancer, and the advisory committee assisting the National Science Fund in administering the award is prepared to consider contributions published during 1943 or in manuscript. In addition, the committee requests recommendations from scientists or persons whose present work comes within the field for which the award is offered and who are achieving outstanding results.

The donor of the Charles L. Mayer Award had in mind the vast possibilities offered for research on the action of chemical agents and physical factors in stimulating or retarding cell growth, and the committee is interested primarily in fundamental studies on the factors influencing the growth of animal cells rather than applications to any particular aspect of normal or abnormal growth. The 1942 award was made to Dr. Charles Huggins, of the University of Chicago, for his work on endocrine control of prostatic cancer.

The advisory committee in charge of recommendations for the 1943 Charles L. Mayer Award includes Dr. Alan Gregg, director for the medical sciences, Rockefeller Foundation; Dr. George H. Whipple, dean of the School of Medicine and Dentistry of the University of Rochester; Dr. Peyton Rous, the Rockefeller Institute for Medical Research; Dr. R. R. Williams, chemical director of the Bell Telephone Laboratories, and Elihu Root, Jr.

SCIENTIFIC NOTES AND NEWS

THE autumn meeting of the National Academy of Sciences will be held in the Academy Building, Washington, D. C., on Monday, November 22. Registration will be at 9 A.M. The meeting will be for members only. It will be confined to academy business and reports from members who are actively engaged in the war effort. It is expected that the session will be limited to one day, beginning at 9:30 A.M. Luncheon, limited to members, will be at 1 P.M. at the Roger Smith Hotel.

THE Board of Directors of City Trusts of Philadelphia announces the conferring of the John Scott Awards on Dr. Otto Stader, veterinary surgeon, Ardmore, Pa., for the invention of the reduction and fixation bone splint; on John C. Garand, chief engineer of ordnance, Springfield Armory, for the invention of the U. S. Rifle Cal. .30 M. 1, and, as already announced in SCIENCE, on Dr. Richard E. Shope, of the Rockefeller Institute for Medical Research at Princeton, N. J., Lieutenant Commander, U. S. Naval Reserve, for the discovery of the complex etiology of swine influenza. The awards will be presented on Thursday evening, November 18, at 8:30 o'clock in the Hall of the American Philosophical Society.

DR. FREDERICK L. HOFFMAN, of the Biochemical Foundation of the Franklin Institute, now retired and living in San Diego, Calif., who was influential thirty years ago in founding the American Society for the Control of Cancer, was on November 2 at the seventeenth annual dinner of the New York City Cancer Committee awarded *in absentia* the "Clement Cleveland Award for 1943." The medal, which is presented annually "for outstanding service in the cause of cancer control," was accepted for Dr. Hoffman by Dr. Howard C. Taylor, attending surgeon at the Roosevelt Hospital. The presentation was made by Mrs. Robert G. Mead, daughter of the late Dr. Cleveland, in whose memory the award was established. This year's dinner of the New York Committee was given in honor of the founders of the American Society for the Control of Cancer. Dr. Clarence C. Little, managing director, reviewed the history of the organization. There was an exhibit showing the advance in cancer control that has taken place during the past thirty years.

THE Philadelphia College of Pharmacy and Science conferred at commencement on November 3 the degree of doctor of science on Dr. Theodore G. Klumpp, president of the Winthrop Chemical Company, in recognition of "distinguished services in medicinal chemistry."

DR. CURTIS SAUNDERS, master sergeant, division of parasitology and tropical medicine of the Army Medical School, Washington, D. C., was elected on October 12 a member of the Royal Institute of Public Health and Hygiene, London.

Dr. Leason H. Adams, director of the Geophysical Laboratory of the Carnegie Institution of Washington, has been nominated as president-elect of the American Chemical Society.

Dr. Henry T. Heald, president of the Illinois Institute of Technology, was elected president of the Association of Urban Universities at its twenty-ninth annual meeting in Chicago; Dr. David D. Henry, executive vice-president of Wayne University, was elected vice-president. Dr. F. W. Shockley, director of the extension and evening divisions and of the summer session of the University of Pittsburgh, will continue as secretary-treasurer.

F. Malcolm Farmer, vice-president and chief engineer of the Electrical Testing Laboratories, has been elected president of the United Engineering Trustees, Inc., the joint agency of the four national societies of civil, mining and metallurgical, mechanical and electrical engineers.

Clyde G. Conley, of the Mt. Vernon Bridge Company, Ohio, has been elected president of the American Institute of Steel Construction.

George Roberts, head of the department of agronomy of the University of Kentucky and agronomist at the experiment station for nearly forty years, retired on July 1 with the title professor of agronomy emeritus. He has been succeeded by Edmund J. Kinney, professor of farm crops and agronomist in charge of tobacco and cereal investigations.

It is reported in the *Journal* of the American Medical Association that Dr. Harold W. Brown has resigned as dean of the School of Public Health of the University of North Carolina, to become professor of parasitology in the newly established department of tropical medicine of the Columbia Presbyterian Medical Center. He is also the first member of the faculty for training and research in tropical diseases, which will function under the immediate direction of the DeLamar Institute of Public Health, a division of the medical school. The project was made possible by a grant of $150,000 from the Josiah Macy Jr. Foundation, which will also defray a concentrated five-year program of research and teaching.

Dr. Paul Herget, absent on leave from the Observatory of the University of Cincinnati to fill a war position at the U. S. Naval Observatory, Washington, has been appointed director of the observatory at Cincinnati. He succeeds the late Dr. Elliott Smith, who died on September 29. Dr. Everett I. Yowell, professor emeritus of astronomy, will continue as acting director until Dr. Herget can be released by the Naval Observatory.

Ronald Martin Foster, until recently a research mathematician in the Bell Telephone System, has joined the faculty of the Polytechnic Institute of Brooklyn as head of the department of mathematics.

Lowell E. Walters, instructor in animal industry at the Louisiana State University, has been appointed assistant professor of animal husbandry at the Massachusetts State College.

Dr. Robert I. Wise, formerly director of the Public Health Laboratory of Houston, Texas, has become assistant professor of bacteriology in the Medical School of the University of Texas. Dr. Glenn Drager, formerly of the department of anatomy of the Medical School of the West Virginia University, has been appointed assistant professor of anatomy.

Frederic H. Miller, associate professor of mathematics and acting head of the department at Cooper Union, New York, has been appointed professor of mathematics and head of the department. He succeeds Professor H. W. Reddick, who has resigned.

Dr. William A. Hooker, senior economic zoologist of the U. S. Department of Agriculture, has retired after serving for forty years.

C. Kenneth Bullock, Chautauqua County, N. Y., agricultural agent since 1930, has been appointed assistant secretary to Earl C. Foster, executive secretary of the New York State Emergency Food Commission.

Dr. Edward I. Salisbury, known for his work in tropical medicine, has been made medical director of the United Fruit Company to succeed Dr. Roland C. Connor, executive vice-president.

Dr. J. C. Hostetter has resigned as vice-president and director of research and development of the Hartford Empire Company, Connecticut, to become president of the Mississippi Glass Company, St. Louis.

The War Department, Washington, D. C., announced on October 21 the appointment of Colonel Stanhope Bayne-Jones, M. C., A.U.S., as director of the United States of America Typhus Commission. According to the *Journal* of the American Medical Association, Colonel Bayne-Jones succeeds Brigadier General Leon A. Fox, U. S. Army, who asked to be relieved as director and appointed field director in order to give all his time to the field work of the commission, which has been operating abroad, particularly in the Middle East, since the first of this year. Colonel Bayne-Jones takes over the directorship in addition to his work as assistant director of the Preventive

Medicine Division, Office of the Surgeon General, where the main office of the commission has been established. Colonel Bayne-Jones was formerly dean of the Yale University School of Medicine and was professor of bacteriology when ordered to active duty early in 1942.

FOLLOWING the death of Dr. Wilmon Newell, provost for agriculture at the University of Florida, director of the Agricultural Experiment Station and Extension Service, plant commissioner, State Plant Board, the following appointments, effective on November 1, have been announced: H. Harold Hume, dean of the College of Agriculture, provost for agriculture and dean of the College of Agriculture; Associate Director Harold Mowry, director of the Agricultural Experiment Station, and Associate Director A. P. Spencer, director of the Agricultural Extension Service. Assistant State Plant Commissioner A. C. Brown has been appointed plant commissioner to succeed Dr. Newell. The plant board is not connected with the University of Florida. The appointment by the Board of Control of Dr. P. J. Westgate as associate horticulturist, for duty with the Sub-Tropical Experiment Station, Homestead, was also announced.

THE *Experiment Station Record* reports that Dr. A. L. Deering, dean of the College of Agriculture of the University of Maine and director of the extension service, has also been given supervision over the Experiment Station in a program to coordinate the three branches of agriculture in the university. Because of the decreased student enrolment, several members of the college faculty have been transferred temporarily to the station for research on a full-time or a part-time basis. Dr. Arthur Hawkins, assistant agronomist of the station, has resigned to accept an appointment with the Bureau of Plant Industry, Soils and Agricultural Engineering of the U. S. Department of Agriculture, but will remain in Maine to carry on research in cooperation with the station.

DR. D. T. MACDOUGAL, of Mt. Carmel, Calif., has resigned as a member of the Board of Managers of the New York Botanical Garden. He is succeeded by Edwin De T. Bechtel. The *Bulletin* of the garden states that Dr. MacDougal's association with the garden began in 1899 when he was appointed director of the laboratory and first assistant. In July, 1904, he was made assistant director, continuing also in charge of the laboratory until he severed his connection at the end of 1905. From 1929 until 1933, he was one of its scientific directors, and was then elected to the board of managers. Dr. MacDougal has been a member of the corporation since the beginning of 1930.

DR. BASSETT MAGUIRE, who returned to New York in August after a summer spent exploring in the mountains of Utah and western Nevada, has been appointed non-resident professor of botany at the Utah State Agricultural College, where he taught for twelve years before accepting his appointment as curator at the New York Botanical Garden, in recognition of services rendered to the college.

DR. JOHN J. BOURKE, regional medical officer attached to the New York Regional Office of Civilian Defense, has been promoted from the rank of major in the U. S. Public Health Service to that of lieutenant colonel. He was formerly chief medical officer for the New York State War Council.

DR. OSCAR IVANISSEVICH, professor of surgery and director of the Surgical Institute at the University of Buenos Aires, exchange professor of surgery at Stanford University for the months of October and November, will give the Morris Herzstein Medical Lectures for 1943 in San Francisco on November 15, 17 and 19. He will speak on "Echinococcosis." The Herzstein Lectures were established in 1929 by the late Dr. Morris Herzstein, of San Francisco, to be given under the direction of the medical schools of Stanford University and the University of California. They are given on alternate years by scientific men of outstanding achievement and are open to the public as well as to the medical profession.

IT is reported in *Nature* that the Parsons Memorial Fund, which is administered by the Royal Society, made provision for a memorial to the late Honorable Sir Charles Parsons in Westminster and for an annual Parsons Lecture to be given in turn under the auspices of eight specified institutions and societies, concerned with the subjects most closely associated with his name. In accordance with the terms governing the appointment of the lecturers, the 1943 lecture, which is the eighth of the series, was given under the auspices of the Physical Society. It was delivered at the meeting of the society at the Royal Institution, on October 15, by the Right Honorable Lord Rayleigh, whose subject was "Optical Topics, in Part Connected with Charles Parsons." Previous lecturers have dealt more especially with other aspects of his work.

BECAUSE of information received that it will not be possible for St. Louis to provide adequate hotel accommodations, the date of the meeting of the annual session of the American Medical Association, which had been scheduled to be held in St. Louis, has been changed by the Board of Trustees. It will now be held in Chicago from June 12 to 16.

THE spring convention of the Electrochemical Society will be held at Milwaukee from April 12 to 15, 1944.

THE forty-ninth summer meeting of the American Mathematical Society and the twenty-fifth colloquium were held in September at the New Jersey College for Women, Rutgers University. The Mathematical Association of America and the Institute of Mathematical Statistics met in conjunction with the society. There was an attendance of about three hundred, including two hundred and forty-two members of the society. The program consisted of three colloquium lectures on "Existence Theorems in the Calculus of Variations," by Professor E. J. McShane; two addresses, "The Complex Method of the Theory of Trigonometric Series," by Professor Antoni Zygmund, and "Finite Deformations of an Elastic Solid," by Professor F. D. Murnaghan. There were six sections for contributed papers, one of which was a joint session with the Institute of Mathematical Statistics. Eighty-eight papers were presented either in person or by title.

THE National Research Council announces that fellowships in mathematics, astronomy, physics, chemistry, geology, paleontology, physical geography, zoology, botany, agriculture, forestry, anthropology and psychology will be available for the year 1944–1945. These fellowships are awarded as a rule to persons under thirty-five years of age who are citizens of the United States or Canada, and who have met all the requirements for the doctor's degree. Applications must be filed on or before December 31, on forms obtainable from the secretary of the Fellowship Board in the Natural Sciences, National Research Council, 2101 Constitution Avenue, Washington 25, D. C. A handbook describing the fellowships—stipends, conditions and tenure—will be furnished upon request.

SCIENCE SERVICE announces that the membership in Science Clubs of America has increased 300 per cent. since this time last year. The third annual science talent search, sponsored by Science Clubs of America and offering $11,000 in Westinghouse science scholarships, is now under way. Entries must be completed by December 27. Over 15,000 high-school seniors competed in a similar contest last year, and it is expected that more than that number will enter this third search for talented science students worthy of financial assistance for higher education.

THE State Legislature of Alabama has made an appropriation making possible the inauguration of a state-wide program of cancer control. For the first year $30,000 has been set aside and for the second year $50,000 to finance the project, which will be administered by the State Board of Health. A cancer control committee has been named by the Medical Association of the State of Alabama.

DISCUSSION

A POSSIBLE RELATIONSHIP BETWEEN THE WALNUT ERINOSE MITE AND WALNUT BLIGHT

IN the late summer of 1942, successful isolation of the walnut blight organism, *Phytomonas juglandis* (Pierce) Bergey *et al.*, responsible for huge annual losses of English walnuts all over the world, was made from a walnut erinose mite, *Eriophyes tristriatus* Nalepa var. *erinea* Nalepa, found hibernating beneath the scales of a healthy, dormant bud on an English walnut tree. Transferred to the surface of a plate of beef agar, colonies of bacteria in mixed culture, including the blight organism, developed from one of a small number of mites so treated. After purification of the cultures, needle puncture inoculations were made on the main stems of young seedling walnuts forced in the greenhouse. Small but characteristic lesions of the disease developed before the trees went dormant and the tissue hardened.

In 1943, young shoots and nuts on mature trees inoculated by the needle puncture method likewise developed characteristic lesions. Similarly, broth suspensions of the bacteria atomized on unwounded nuts produced numerous lesions. Corresponding controls in all the experiments referred to remained healthy.

Smith[1] pointed out over thirty years ago that flies attracted to the black, slimy sap that often oozes from blight lesions and which teems with the bacteria may become contaminated. Since wounds or abrasions of the epidermis of susceptible tissue are not necessary for infection, he assumed that flies disseminate the disease by simply tracking the bacteria over susceptible surfaces, or on their mouth parts. It must be recognized that flies are not obligate parasites[2] of the walnut and their presence in a tree is casual or accidental. Thus the role they play in the dissemination of the disease must be a variable one if they actually constitute a factor at all.

The successful isolation of the blight bacteria from the walnut erinose mite marks the first instance that a strictly obligate parasite of the English walnut has been found to harbor the organism. Whether the walnut erinose mite can actually transmit the disease to the nuts is not yet proved, but it does not seem im-

[1] C. O. Smith, *Calif. Agr. Exp. Sta. Bul.* 231, 1912.

[2] Even the walnut husk fly, a serious parasite of walnuts in Southern California, is not an obligate parasite of the walnut. The first authentic report of its presence in the state occurred as late as 1926, consequently the flies C. O. Smith worked with were entirely different and probably not parasites on walnuts at all.

probable. The mites, microscopic in size, are omnipresent on walnuts and abound by the millions on trees of all sizes and ages where they produce erinea or galls on the foliage. Heretofore, except for the hypertrophies they produce on the leaves, they have been regarded as of no importance. In the light of the present discovery it may be necessary to take them more seriously. This is true with regard to existing methods of controlling bacterial blight, since the sprays now in use for controlling the disease do not destroy the mite. This factor may be responsible for certain irregularities observed from time to time in the control of the disease with sprays.

Grateful acknowledgment is made to Dr. Leslie M. Smith, one of the few authorities on Eriophyid mites in California, for his considerable assistance in handling the mites used in the experiments.

B. A. RUDOLPH

DECIDUOUS FRUIT STATION,
UNIVERSITY OF CALIFORNIA,
SAN JOSE, CALIF.

ANOTHER DISCOVERY OF CHAOS CHAOS

IN 1936 Schaeffer[1] rediscovered Chaos Chaos in a New Jersey marsh. In the spring of 1942, we found several large specimens of the animal in a shallow pond in Cunningham Park, New York City. In the spring of 1943, we collected several large specimens, some measuring 900 μ, in the same pond.

These animals responded readily to culturing by the method of Brandwein.[2] The agar which serves to anchor the rice grains (as described in this method) was eliminated. Large quantities of these animals are now on hand. They are able to ingest such animals as Frontonia, Stentor, Spirostomum, Blepharisma, different Rotifera and some of the smaller Turbellaria.

The animals seem to be Schaeffer's type A, in the main. Some of the animals, however, have the ellipsoid nucleus of the so-called type B.

PAUL F. BRANDWEIN
PATRICIA PENN
CLARE SHIEL

FOREST HILLS HIGH SCHOOL,
FOREST HILLS, N. Y.

TENNYSON'S PREDICTION OF THE INVENTION, USE AND MISUSE OF THE AEROPLANE

ON several previous occasions I have, in these columns, drawn attention to a number of remarkable predictions concerning the invention, use and misuse of aeroplanes. In all these cases the prophets were scientists. I have elsewhere drawn attention to similar predictions made by literary men.[1] The prediction concerning the aeroplane which is perhaps the most remarkable of all is by Alfred Tennyson, and occurs in his poem "Locksley Hall," published in 1842.[2]

The relevant stanzas are as follows:

Men, my brothers, men the workers, ever reaping something new:
That which they have done but earnest of the things that they shall do;

For I dipt into the future, far as the human eye could see,
Saw the Vision of the world, and all the wonders that would be;

Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down with costly bales;

Heard the heavens filled with shouting, and there rained a ghastly dew
From the nation's airy navies grappling in the central blue;

Far along the world-wide whisper of the south-wind rushing warm,
With the standards of the people plunging thro' the thunder-storm;

Till the war-drum throbb'd no longer, and the battle-flags were furl'd
In the Parliament of man, the Federation of the world.

There the common sense of most shall hold a fretful realm in awe,
And the kindly earth shall slumber, lapt in universal law.

So I triumph'd, ere my passion sweeping thro' me left me dry,
Left me with the palsied heart, and left me with the jaundiced eye;

Eye, to which all order festers, all things here are out of joint,
Science moves, but slowly, slowly, creeping on from point to point:

Slowly comes a hungry people, as a lion creeping nigher,
Glares at one who nods and winks behind a slowly-dying fire:

Yet I doubt not thro' the ages one increasing purpose runs,
And the thoughts of men are widen'd with the process of the suns.

M. F. ASHLEY MONTAGU

HAHNEMANN MEDICAL COLLEGE
AND HOSPITAL,
PHILADELPHIA

---

[1] A. A. Schaeffer, *Turtox News*, 15: 114–115, 1937.
[2] P. F. Brandwein, *American Naturalist*, 69: 628, 1935.

[1] "Four on War," *Technology Review*, April, 1943.
[2] *Poems by Alfred Tennyson*, 2 vols., London, 1842.

SCIENTIFIC BOOKS

HEAT ENGINES

The Theory and Practice of Heat Engines. By D. A. Wrangham. xii + 756 pp. Illustrated. Cambridge at the University Press. $10.50.

In setting out to place under one cover all the details about heat engines from history to the latest gas turbine work, the author has indeed chosen a Herculean task. Is it any wonder then that the reader on closing the book is left with a confused opinion of good, bad, indifferent? In the preface appears the sentence, "In writing this book the author has kept in mind the tremendous amount of ground which the student of to-day is expected to cover." Who expects the student to cover so much? This expectation is a debatable one pedagogically; and the resulting textbook—it is certainly not a treatise—is a debatable one from many points of view.

Again in the preface, "In the treatment of this subject the author has endeavored to reduce things to their first elements, . . . ," a noble goal indeed. But there follows, "For this reason the molecular theory has been introduced . . ." as though this were the basis of the operation of heat engines. The real basic theory of the interrelation of thermal energy to mechanical energy is the branch of science known as thermodynamics. The beauty and generality of thermodynamics lies in the fact that all the results follow from a few simple laws entirely devoid of any assumptions about the microscopic constitution of matter. Thermodynamics in heat engines as in other applications is not a sterile theory but supplies the basic formulas by which all energy computations are made. Kinetic theory on the other hand may supply to the study of heat engines an intellectually pleasing and sometimes useful qualitative picture of events, but it does not supply any useful quantitative results which can not better be obtained from thermodynamics. The author is entirely correct when he says, "There is very little to be remembered in the fundamental laws which control heat engines, but it is in their application where troubles arise," but it is disappointing to find nowhere in the book a clear statement of what these fundamental laws are. The student new to the subject must indeed be clever to find the unstated fundamental laws in operation in the "large number of worked examples . . . included . . . for this reason."

This picture of the unsatisfactory treatment of the *theory* of heat engines would not be complete without the quotation of a few of the many statements which are sufficiently vague to defy classification or which put in the same sentence unrelated material. On page 8, "In England practical engineers are brought up on the Fahrenheit scale, and can think only in terms of it. Now since these men have but few computations to make. . . ." This is an argument for the use of the Centigrade scale. On page 14, "Such a volume of gas (358 cu. ft. at N.T.P.) is known as a Mol and is a more convenient unit than a cubic foot; the misfortune is that such a quantity was not introduced before the foot, otherwise we might have had a better system of units." On page 51, "A gas is said to expand adiabatically if no caloric heat is extracted from or rejected to an *External Source,* and that internally there is neither chemical action nor other losses which would reduce the stock of internal energy." Is this statement consistent with the first law of thermodynamics? And now from later in the book, page 377, in a section on "Value of Dimensionless Ratios" there appears the following: "Further, a curve which is to represent the complete relation between the quantities involved should have the same dimensions for ordinate as for abscissae, so that the function is virtually plotted against itself." An interesting nontechnical point appears on p. 504. In discussing chemical symbols ". . . only the first letter of the English or Latin names of the commoner elements is used to denote it; whilst less common elements, . . . are distinguished by an additional letter, thus: Carbon is denoted by C, Chlorine is denoted by Cl" and Argon by A and Silver by Ag, etc.

Many of the doubtful statements in the book are to long or too technical to quote in this review, but the essence of the criticism is that the fundamental laws of nature governing heat engines are not made sufficiently clear, either by statement or in application, to even be discovered by any one but an informed reader.

So far this review has had few nice things to say about the book. To stop at this point would be unfair. The author is certainly well informed on the details of construction and operation of many types of heat engines. These include modern power plant equipment as well as those of historical importance. The brief historical sketch at the beginning of each new type of equipment was both interesting and informative.

The very generous number of examples worked in minute detail is certainly admirable. In many places the examples seem to be too difficult for the text preceding them, but otherwise are well chosen to illustrate the kinds of problems encountered in practice.

The book attempts to cover the thermodynamic, fluid flow, and heat transfer aspects of all types of heat engines and their auxiliary equipment. There is treated in order heat power cycles, air compressors and motors, reciprocating steam engines, refrigeration, condensers, steam turbines, power plants, internal combustion engines and steam boilers. While many constructional details are given, no discussion of the mechanical problems to be met in their design is attempted. However, under each type of equipment an enumerated list of advantages and disadvantages is given which helps the reader to form a balanced opinion on current models of heat engines.

The book contains a very generous number of figures and illustrations, many of which are printed in color. These add much to the clarity of the material presented as well as to amusement. Fig. 17 for example shows a Carnot cycle complete with source, the sun with a face, and a sink, icebergs, polar bear and all. In the preface the author notes that text-books like any given item of engineering practice have an average life of only ten years. This book serves to bring similar earlier texts up to date, a purpose that is accomplished, but nothing more.

HOWARD W. EMMONS

HARVARD UNIVERSITY

SPECIAL ARTICLES

THE IN-VITRO DESTRUCTION OF CAROTENE BY WATER EXTRACTS OF MINCED RAT STOMACHS IN THE PRESENCE OF METHYL LINOLATE

SHERMAN[1] has demonstrated that carotene administered to vitamin A deficient rats is inactivated by the simultaneous feeding of methyl linolate. The destructive action of the methyl linolate can be prevented by small amounts of α-tocopherol. It was shown that the carotene was destroyed in the gastrointestinal tract, but the exact site and the mechanism of the destructive action was not clear. The mixing of the carotene and methyl linolate with the basal ration, *in vitro*, did not elucidate the problem, since in this case carotene destruction occurred much too slowly to explain the *in vivo* results. The same was true when the carotene and linolate were mixed with stomach or intestinal contents. Results similar to the above have been noted by Quackenbush, Cox and Steenbock[2] and by Hickman, Harris and Woodside.[3]

This paper offers a possible explanation of the above results by demonstrating the rapid *in vitro* destruction of carotene by a clear water-extract of minced rat stomach in the presence of methyl linolate.

The stomach extract is prepared by suspending the minced stomach mucosa of the freshly killed rat in ten times its weight of distilled water, allowing it to stand for 15 minutes and then centrifuging at high speed for 10 minutes. The supernatant liquid has a dry matter content of 5 mg per ml. The extract must be clear. If the minced stomach is ground in a mortar before extracting it is impossible to clarify by centrifuging and such extracts show no carotene destructive potency when tested according to the method described below.

For purposes of comparison the mode of action and potency of the so-called "carotene oxidase" or lipoxidase[4] of the soybean has been investigated. A 0.5 per cent. suspension of the ground soybean was centrifuged after standing for 30 minutes. This extract contained 2 mg of dry matter per ml.

The carotene-destroying potency of the above extracts is determined as follows. One ml. of a 0.25 per cent. solution of highly purified methyl linolate in acetone is placed in a 125 ml Erlenmeyer flask. Ten ml of water is added, followed by one ml of McIlvaine's citric acid-sodium phosphate buffer, pH 5.7, and one ml of carotene in acetone (equivalent to 68 micrograms of carotene). Finally the extract to be tested is added (usually one ml), the flask stoppered and incubated for periods up to 30 minutes at 38° C. The reaction is stopped with hydrochloric acid and the carotene is transferred to 50 ml of ethyl ether by vigorous shaking until the water phase is clear and colorless. The carotene is then determined colorimetrically by means of the Evelyn photoelectric colorimeter. For the control, a flask containing the linolate, carotene, water and buffer is incubated as above; hydrochloric acid is added and followed by the extract under test. The carotene is immediately extracted with ether. The recovery of carotene in this case is always above 95 per cent. of the amount added. The carotene destructive potency of the material under test is calculated as the percentage loss with reference to the control run at the same time.

The results of the destructive action on carotene of increments of stomach extracts of normal adult rats are shown in Table 1. The potency of the extract is greatly reduced by heating on a boiling water water bath for 15 minutes. Without methyl linolate the action of the stomach extract is insignificant.

The action of the stomach extract is very similar to that of soybean "carotene oxidase." However, some differences do exist which indicate that the active agent is not the same in both cases. From Table 2 it is evident that although the soybean enzyme is inhibited

---

[1] W. C. Sherman, *Proc. Soc. Exp. Biol. and Med.*, 47: 199, 1941; *Jour. Nutrition*, 22: 153, 1941.

[2] F. W. Quackenbush, R. P. Cox and H. Steenbock, *Jour. Biol. Chem.*, 145: 169, 1942.

[3] K. C. D. Hickman, P. L. Harris and M. R. Woodside, *Nature*, 150: 91, 1942.

[4] R. J. Sumner, *Jour. Biol. Chem.*, 146: 215, 1942.

TABLE 1

THE DESTRUCTION OF CAROTENE BY WATER EXTRACTS OF MINCED RAT STOMACH MUCOSA AS COMPARED WITH SOYBEAN "CAROTENE OXIDASE"

Volume extract	Rat stomach mucosa extract*			Sobyean extract		
	Number of determinations	Destruction of carotene		Number of determinations	Destruction of carotene	
		Range	Average		Range	Average
ml		*Per cent.*	*Per cent.*		*Per cent.*	*Per cent.*
1.0	6	57.8–86.2	74.2	6	70.0–78.5	74.0
0.5	6	61.0–79.7	70.8	4	48.8–72.8	61.9
0.25	2	58.8–69.1	64.0	..	....	...
0.20	4	51.0–55.8	54.1	2	40.0–44.4	42.2
0.10	1	....	45.3	2	28.7–32.5	30.6
0.05	1	....	28.0	..	....	...
1.0 (no Linolate)	5	0–28.0	12.2	3	0–35.0	15.0
1.0 (heated)†	1	....	36.8	..	....	...
0.5 "	1	....	32.8	..	....	...
0.1 "	1	....	20.0	..	....	...

* Rats were on a stock diet: Average weight of the six rats used was 215 grams.
† The extract was heated on a boiling water bath for 15 minutes.

by a water extract of a low-grade wheat flour, the active agent in the stomach extract is not. On the other hand, the stomach extract appears to be more susceptible to inhibition by α-tocopherol than does the soybean extract. A further point of difference between the two extracts became evident in a study of the pH activity curves. Over a pH range of 3.0 to 6.6 using the citric acid-sodium phosphate buffer system the soybean lipoxidase was inactive below pH 4.0 and showed its maximum at about pH 5.5; the falling off was gradual on the alkaline side of the optimum. However, the rat stomach showed considerable activity even at pH 3.0. This may have a relation to a natural resistance to the acidity of the normal stomach possessed by this active carotene-destroying agent. In other respects the pH activity curve of the stomach extract was very similar to that of the soybean enzyme. The pH optimum was 5.7 and the falling off on the alkaline side was gradual.

TABLE 2

COMPARATIVE INHIBITION OF RAT STOMACH AND SOYBEAN "CAROTENE OXIDASE" BY TOCOPHEROL AND CENTRIFUGED 5 PER CENT. WATER EXTRACT OF SECOND CLEAR WHEAT FLOUR

Incubation time	Rat stomach extracts* †			Soybean extracts†		
	Number of determinations	Destruction of carotene		Number of determinations	Destruction of carotene	
		Range	Average		Range	Average
Minutes		*Per cent.*	*Per cent.*		*Per cent.*	*Per cent.*
15	5	35.5–65.9	52.6	3	65.1–70.5	67.6
30	14	56.8–81.9	70.1	3	71.3–80.8	76.0
30 (plus flour extract)	5	51.5–78.9	66.8	5	23.6–43.5	37.1
15 (1 mg) (Tocopherol)	1	....	5.0	1	....	42.0
30 (1 mg) (Tocopherol)	1	....	25.0	1	....	45.5

* Rats had been on a synthetic ration composed of 30 per cent. lard, 5.5 per cent. salts, 25 per cent. casein, sucrose and synthetic vitamins. Average weight was 178 grams.
† One ml of extracts used.

Other organs have been tested for a carotene-destroying agent in their water extracts. Preliminary results have shown that liver is quite potent while muscle and small intestine appear to have little or no potency. However, it should be mentioned that the extracts of small intestines were not clear and contained a large amount of extraneous material. As mentioned above, lack of clarity in stomach extracts indicates a resistance to destruction of carotene, and the same may be the case with the intestinal extracts. The fact that muscle extract shows no potency appears to exclude the possibility that the destructive action of the tissue extracts on carotene is an artifact resulting from iron-porphyrins or similar compounds extracted from the blood contained within the organs.[5]

Some time after the above results were obtained an attempt was made to repeat certain phases but with slightly anomalous results. No apparent change in the procedure was made, but a new supply of methyl linolate was employed, with the result that a lag phase of from one to two hours incubation time was noted during which little or no destruction of carotene occurred. However, after this time interval carotene destruction began and proceeded rapidly to near completion within 30 minutes. The general results were the same as previously noted, in that methyl linolate was required in conjunction with the stomach extract, neither being effective by itself. This peculiarity may have been caused by a small amount of an antioxidant in the new batch of linolate, or it may have been related to a variation in the efficiency of extraction of the active agent from the minced stomach.

E. L. HOVE
LABORATORY OF ANIMAL NUTRITION,
ALABAMA POLYTECHNIC INSTITUTE

AN UNIDENTIFIED NUTRIENT REQUIRED FOR PROPER UTILIZATION OF DL-ALPHA-TOCOPHEROL BY THE CHICK[1]

DURING attempts to study the rôle of vitamin E in chick nutrition with a simplified ration, the chick was not protected from a vitamin E and A deficiency when these vitamins were included in the ration at a level several times the requirement. Slanetz and Scharf[2] reported that soybean phosphatides promoted proper utilization of vitamin A in the rat. Quackenbush, Cox and Steenbock[3] found that dl-alpha-tocopherol was an antioxidant for vitamin A and carotene.

---

[5] F. Haurowitz, P. Schwerin and M. M. Yenson, *Jour. Biol. Chem.*, 140: 353, 1941.

[1] Technical Contribution No. 107, South Carolina Agricultural Experiment Station. Published by permission of the director of the South Carolina Agricultural Experiment Station. We are indebted to Merck and Company, Inc., Rahway, N. J., for dl-alpha-tocopherol; Anheuser-Busch and Company, St. Louis, Mo., for dried brewers' yeast; Distillation Products, Inc., Rochester, N. Y., for vitamin A; Central Soya Company, Inc., Decatur, Indiana, for soybean phosphatides; and E. I. du Pont de Nemours and Company, New Brunswick, N. J., for vitamin D_3.

The percentage composition of the basal ration was as follows: Dextrin 52.3, Cellophane 3, casein (purified) 30, gelatin 5, salts 4.6, lard 5 and choline 0.1. In addition each one hundred grams of the ration contained 200 I. U. vitamin D_3, 800 I. U. vitamin A (natural esters), 0.1 mg 2-methyl-1,4-naphthoquinone, 0.5 mg thiamin, 1 mg riboflavin, 0.5 mg pyridoxin, 2 mg Ca-pantothenate, 2 mg nicotinic acid, 30 mcg biotin, 1 mg inositol and a fuller's earth eluate equivalent to 12 grams of dried brewers' yeast. This ration is adequate in all water-soluble nutrients required for normal growth of the chick; however, it is inadequate in vitamin E and an unrecognized fat-soluble substance which is necessary for proper utilization of vitamin E. This unrecognized nutrient is found in yeast and soybean phosphatides. It can be removed from yeast by extraction with hot Skellysolve B and is soluble in ether, Skellysolve B and Stoddard solvent.

The data presented in Table 1 summarize the study on the unrecognized fat-soluble nutrient. Chicks receiving only the basal ration (Trial 1) started to develop vitamin E deficiency symptoms at about 12 days of age, and by the 28th day severe vitamin A and E deficiency symptoms were present. Those receiving 0.001 per cent. dl-alpha-tocopherol, trial 2, developed vitamin A and E deficiency symptoms simultaneously with those in trial 1. When the basal ration was supplemented with 0.001 per cent. dl-alpha-tocopherol plus 5 or 10 per cent. dried brewers' yeast, they developed normally. If they received 0.001 per cent. dl-alpha-tocopherol plus 5 per cent. brewers' yeast which had been extracted for 72 hours in a Soxhlet extractor with hot Skellysolve B, they developed vitamin E and A deficiency symptoms. If the basal ration was made adequate in dl-alpha-tocopherol and supplemented with 2 per cent. soybean phosphatides the chick developed normally. When the chicks were given massive dosages of vitamin A (4,000 I. U. per day) for the first three days of life and also the basal ration made adequate in vitamin E, they developed only vitamin E deficiency during the first 35 days of life.

TABLE 1

INFLUENCE OF DIFFERENT SUPPLEMENTS ON THE DEVELOPMENT OF VITAMIN E AND A DEFICIENCY SYMPTOMS IN CHICKS

Trial	Supplement to basal ration	Observations up to 5 weeks of age		
		Mortality	Vitamin E deficiency	Vitamin A deficiency
		Per cent.	Per cent.	Per cent.
1	None	100	83	100
2*	dl-alpha-Tocopherol	100	90	100
3*	dl-alpha-Tocoperol, 5 per per cent. yeast	0	0	0
4*	dl-alpha-Tocopherol, 10 per cent. yeast	0	0	0
5*	dl-alpha-Tocopherol, 2 per cent. soybean phosphatides	0	0	0
6*	dl-alpha-Tocopherol, 5 per cent. extracted yeast..	100	70	100
7	5 per cent. extracted yeast	100	60	100
8*	dl-alpha-Tocopherol, massive vitamin A dosage.	20	67	0

* dl-alpha-Tocopherol was added at a level of 0.001 per cent.

H. PATRICK
C. L. MORGAN

POULTRY DEPARTMENT,
CLEMSON AGRICULTURAL COLLEGE,
SOUTH CAROLINA

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A METHOD FOR INDICATING THE MOISTURE CONTENT OF FOODS DURING DEHYDRATION[1]

IN the dehydration of foods, such as vegetables, fruits, meats, etc., there is a great need for a method which will indicate, in the dehydrators, the moisture content of the dehydrating material and which will tell when the material has dried to the proper or preferred moisture content and is ready to be removed. At the present time, three different methods are used for this purpose: (1) appearance and feel of the material by hand; (2) taking a sample and determining its moisture content; and (3) dehydrating the material for a definite and predetermined length of time. Obviously, for one reason or another, these methods can not be considered entirely satisfactory.

It is the purpose of this note to present a method which can be used in dehydrators to indicate, by proper calibration, the moisture content of the dehydrating material at the various stages of dehydration and to tell when the material has dried to the proper or preferred moisture content and is ready to be removed.

The method is based upon the well-known phenomenon that the evaporation of water lowers the temperature. When the fresh material is being dehydrated, there are two temperatures, that of the chamber and that of the material itself. At the beginning, when the material contains its maximum water content, the evaporation of the water lowers its temperature far below that of the chamber. As the material becomes progressively drier its temperature becomes progressively higher, until finally both temperatures come close together. At this point, the material reaches a degree of dryness which is very close to the commonly desired moisture content.

---

[2] C. A. Slanetz and A. Scharf, *Proc. Soc. Exp. Biol. and Med.*, 53: 17, 1943.

[3] F. W. Quackenbush, R. P. Cox and H. Steenbock, *Jour. Biol. Chem.*, 145: 169, 1942.

[1] Journal article No. 600, new series.

The procedure consists of placing two thermometers in the dehydrator. The bulb of one thermometer is bare and is simply hanging in the chamber. The bulb of the second thermometer is covered with a definite amount of the dehydrating material contained in a small bag of cheesecloth and is placed on one of the loaded trays. The bag with the material is held around the bulb by rubber bands which tend to exert pressure continuously. The area and amount of material placed in the cheesecloth bag are definite and constant and are related to the amount and thickness of the layer of the material on the trays.

The cheesecloth bag technique is universal in application, in that, by means of it, almost any kind of material can be tied around the bulb of the thermometer. For example, peas and carrots can be tied as effectively and readily as slices of potatoes, apples or leaves of spinach.

The thermometers used in this method are specially devised and are well suitable for the purpose. They are electrical resistance thermometers, using, as resistor, a liquid instead of metal. They have a range from 2,500,000 ohms at 32° F. to 25,000 at 185° F. They are about 30,000 times more sensitive than the metallic electrical resistance thermometers. The electrical resistance values are read on a special wheatstone bridge. The bulb of the thermometers is made of glass and is 25 mm long and 8 mm in diameter. The wire leads are composed of the ordinary lamp-cord and can be of any length. These new electrical thermometers seem to be admirably suited for dehydration work. The wire leads make it possible and convenient to read the temperatures from the outside of the dehydrator.

The type of results obtained by this method is shown in Fig. 1. The material dehydrated is cabbage. It will be seen that the electrical resistance of the uncovered thermometer attains the temperature of the chamber very quickly and fluctuates as that temperature varies. The electrical resistance of the covered thermometer, however, remains at a higher level (lower temperature) for some time, and when the bulk of the water is evaporated, it begins to decrease, and finally almost reaches, to within 1,000 ohms, the resistance of the uncovered thermometer. At this point, the moisture content of the cabbage is 4.5 per cent., by vacuum oven determination, which is close to the lower range of the preferred moisture content. It is clearly evident from this chart that by calibration it is possible to know during the dehydration when the material has reached the desired moisture content.

The method has been tested on almost all the various materials commonly dehydrated, and in every case it has proven successful, dependable and accurate. Relying entirely upon this method, it has been possible to dehydrate many materials for the first time down to the preferred moisture content with surprisingly persistent accuracy and without resorting to any other aid. Results of checks agreed to within about 1 per cent.

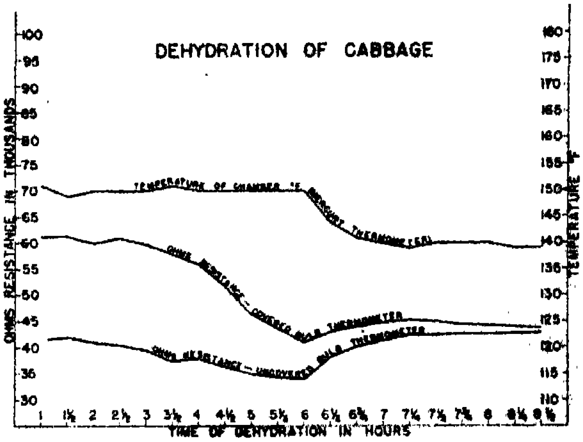


FIG. 1

While the method has been used thus far mainly in the non-moving type of dehydrators, there is no reason why it can not be adopted and used also in the conveyor or any other type of dehydrator.

The method is based upon sound fundamental principles and should fill the great need for a simple, direct and reliable method for indicating the moisture content of the dehydrating material, and for telling when the material has reached the desired moisture content and is ready to be taken out of the dehydrators. A comprehensive report is forthcoming.

GEORGE BOUYOUCOS
H. A. CARDINELL

MICHIGAN AGRICULTURAL
EXPERIMENT STATION,
EAST LANSING

BOOKS RECEIVED

BUNCH, C. C. *"Clinical Audiometry."* Illustrated. Pp. 186. C. V. Mosby Company. $4.00.

BYRD, OLIVER E. *Health Instruction Yearbook 1943.* Pp. ix + 308. Stanford University Press. $3.00.

LEADERMAN, HERBERT. *Elastic and Creep Properties of Filamentous Materials and Other High Polymers.* Illustrated. Pp. xii + 278. Textile Foundation, Washington, D. C.

SCIENCE

VOL. 98 FRIDAY, NOVEMBER 26, 1943 No. 2552

Petroleum, Past, Present and Future: DR. PER K. FROLICH 457

Obituary:
Barbara Stoddard Burks: DR. KATHERINE S. BREHME. *Frederick Joseph Taussig:* DR. E. V. COWDRY. *Recent Deaths* 463

Scientific Events:
British Vital Statistics; The Hooker Scientific Library; The American Ornithologists' Union; The History of Science Society; The American Society of Mechanical Engineers; Declaration of Citizens of Argentina 465

Scientific Notes and News 468

Discussion:
Mental Maladjustment and Color Vision: PROFESSOR KNIGHT DUNLAP. *The Science Mobilization Bill:* PROFESSOR LELAND H. TAYLOR. *Dates of Publication of Scientific Papers:* PROFESSOR CURTIS W. SABROSKY. *More on "Starring":* DR. F. C. WHITMORE, RICHARD W. FOSTER 470

Scientific Books:
Ornamental Plants: PROFESSOR A. W. DIMOCK. *Rays:* DR. S. REID WARREN, JR. 474

Reports:
A Progress Report on the Construction of Population and Physiographic Maps for the State of Missouri: DR. CLARENCE B. ODELL 476

Special Articles:
A Further Interference in Experimental Poliomyelitis: DR. GILBERT DALLDORF and ELINOR WHITNEY. *The Tryptophane Content of a^+a^+ and aa Ephestia Kühniella Z.:* DR. ERNST CASPARI 477

Scientific Apparatus and Laboratory Methods:
A Simple Analytical Method for the Determination of Propylene and Triethylene Glycol: DR. SHERMAN FRIED, DR. EDWARD BIGG and PROFESSOR B. H. JENNINGS. *A Simple Method for Preparing Aqueous Suspensions of Urinary Sex Hormone Residues:* DR. BENJAMIN F. STIMMEL 479

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

PETROLEUM, PAST, PRESENT AND FUTURE[1]

By Dr. PER K. FROLICH

ESSO LABORATORIES, STANDARD OIL DEVELOPMENT COMPANY, ELIZABETH, N. J.

Synopsis: This paper reviews the recent remarkable progress in the petroleum field. Our growing dependence on the products of the oil industry has resulted in considerable concern regarding the ability to supply our future needs for liquid hydrocarbons. The proved reserves of crude oil correspond to some fifteen years' consumption at the prewar rate. However, the excessive wartime requirements for petroleum have led to such a high rate of withdrawal from these underground reservoirs that we may not be able to keep up with the demand for long. In addition to the proved reserves of petroleum known to be present in the earth, large but as yet undiscovered petroleum resources may be expected to exist in various parts of the world. How long we can continue to find this oil and bring it to the surface at the desired rate is a question, but it is certain that eventually a shortage in natural petroleum will occur. When that time comes, it should be possible to supply our needs for gasoline and other hydrocarbon products from such alternate sources as natural gas, shale oil and coal. It is concluded that there need be no sudden change as far as the supply and consumption of gasoline and other petroleum derivatives are concerned. Future developments in this field will probably be characterized by further technological progress, increased drilling for oil on a world-wide basis, necessary adjustments in supply and demand, and a gradual shift to synthetically produced hydrocarbons.

A GREAT deal of attention is currently being devoted to the petroleum situation. Until a short while ago we were primarily concerned with the transportation problem. The question of getting available petroleum products to where they were needed seemed to overshadow all other considerations. Now that the transportation difficulties gradually are being overcome, our interest is turning to the question of the country's ability to produce crude oil to supply the present and future demands for petroleum products.

---

[1] Presented before the general meeting at the 106th meeting of the American Chemical Society, Pittsburgh, Pa., and printed in the November issue of *Industrial and Engineering Chemistry*. Unless stated otherwise, the charts shown are based on data from the Bureau of Mines and other Government agencies, "Petroleum Facts and Figures" (1941 and previous editions), and on petroleum industry figures.

Our industrialized civilization is fundamentally based on the utilization of mineral resources. It is therefore not surprising that, in the forty-year period of industrial expansion in this country, the world's mineral production has been greater than in all preceding history.[2] In the United States petroleum and its by-products in terms of dollar value account for 40 per cent. of the total mineral production.[3] Half of the crude oil used to date in this country has been taken out of the ground in the last twelve years.

The importance of petroleum in relation to other available sources of energy is brought out by Fig. 1; it is seen that some 40 per cent. of our energy (B. t. u. equivalence basis) comes from crude oil and natural gas. A peak of 43.5 per cent. was actually reached in 1938. Some of the remarkable growth indicated for this energy source represents a shift from coal, but most of the gain in the recent twenty-year period is due to the development of new forms of transportation based on the use of liquid fuels.

U. S. ENERGY SOURCES

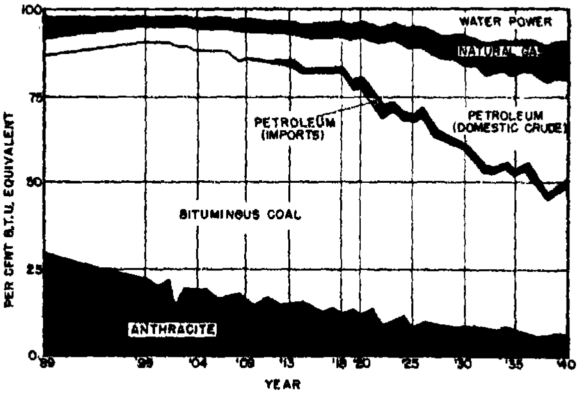


FIG. 1. Percentage of total B.T.U. equivalent contributed by the several sources of energy, counting water power at constant fuel equivalent, 1889–1940. If water power is counted at the prevailing fuel equivalent of central stations in each year, its proportion is 3.2 per cent. in 1899 and 3.5 in 1940, and the proportions of other sources of energy are affected accordingly (reproduced from Bureau of Mines Minerals Year Book Review of 1940, page 776).

This trend toward motorized transportation has not only been responsible for a greatly increased production of crude oil, but has also resulted in the conversion of a gradually increasing proportion of the crude into gasoline. According to Fig. 2, the yield of gasoline on crude increased from 25 per cent. in 1919 to some 45 per cent. in 1932. How the technological developments in cracking made this rise possible is so well known to chemists that it requires no further discussion.

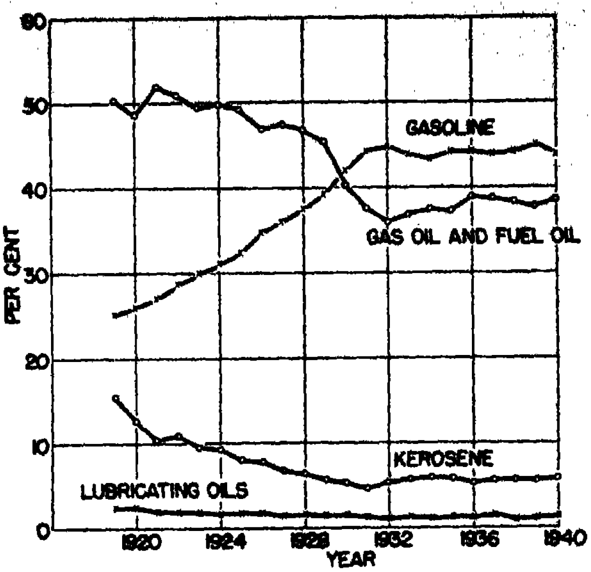


FIG. 2. Average yield of principal petroleum products per barrel of crude oil produced.

That the average gasoline yield has leveled off in the 43–45 per cent. region during recent years is purely a matter of relative demand for the various products from petroleum. From a technological standpoint there is nothing to prevent it from going higher. In-

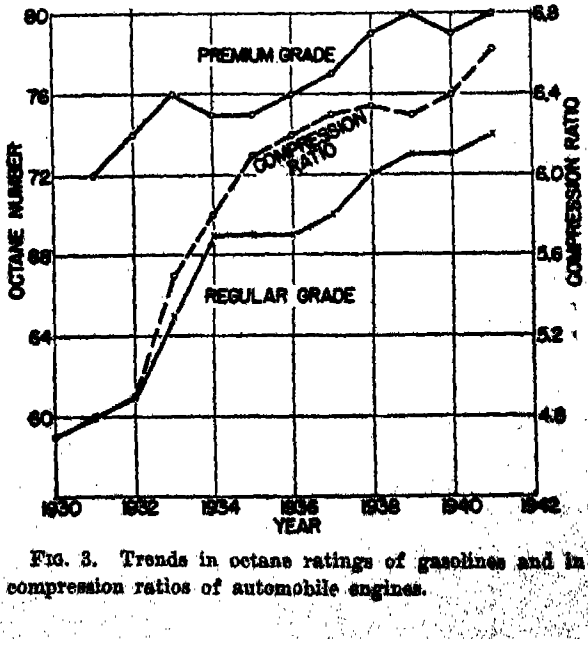


FIG. 3. Trends in octane ratings of gasolines and in compression ratios of automobile engines.

---

[2] C. K. Leith, J. W. Furness and C. Lewis, "World Minerals and World Peace," Washington, Brookings Institution, 1943.

[3] "Petroleum Facts and Figures," 7th ed., New York, American Petroleum Institute, 1941.

deed, it is entirely feasible by catalytic cracking under high pressure of hydrogen to convert crude oil to gasoline, volume for volume.

Along with the increase in yield of gasoline there has also been a marked improvement in quality. One of the important factors as far as quality of motor fuel is concerned is octane number. The progressive increase in octane rating shown in Fig. 3 may be taken as evidence of the petroleum industry's ability to control the chemical composition of its fuels; it can also be seen from this figure that the improvement in octane number, by and large, parallels the engine builder's increase of compression ratio, which in turn is a criterion of the power output that can be obtained per unit of fuel.

As a result of the progress made by both the petroleum and automotive industries, the American public has become increasingly dependent upon motorized transportation. Fig. 4 shows the growth in number of passenger cars registered, as well as in the average gasoline consumption per car. The depression of the thirties brought home to all of us how dependent modern society has become upon the automobile. It was frequently stated then that the last thing the average man was willing to give up was his private means of transportation. The family car stood out as ranking with shelter, food and clothing as a necessity of life. Many were the instances related in which the car seemed to head the list. This situation is brought out in Fig. 4, which shows an inconceivably small sacrifice in automobile use during the depression. It should be noted that these data concern passenger cars only. Had busses and trucks been included, the resulting curves for total car registration and average fuel consumption would have shown almost imperceptible dips. This record of the past leaves no doubt that the American public has a live interest in the future of petroleum.

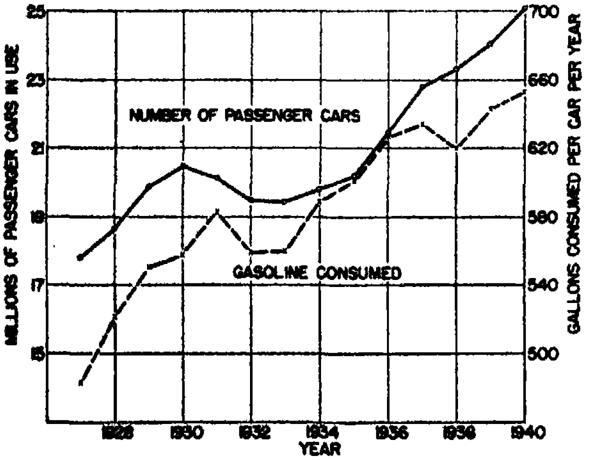


FIG. 4. Passenger cars in use in the United States and their consumption of gasoline.

It is not only motorized transportation, however, that is dependent upon an adequate supply of petroleum. During the recent period of expanded crude oil production, our entire mode of living has become geared to the use of petroleum products. Industry, agriculture and shipping alike are large consumers of a multitude of hydrocarbon materials derived from petroleum sources. The list includes such varied products as industrial and process oils, greases and extreme pressure lubricants, asphalts and road oils, solvents and insecticides, and an ever-increasing number of chemical raw materials and derivatives. The petroleum chemicals business, which already had contributed a considerable volume of various alcohols and related products, has recently been called upon to increase several fold the country's supply of toluene for explosives and to furnish two thirds of the butadiene for the synthetic rubber program. According to Ickes[4] the production of toluene from petroleum will, by the end of the current year, be nearly six times that obtained from all by-product operations.

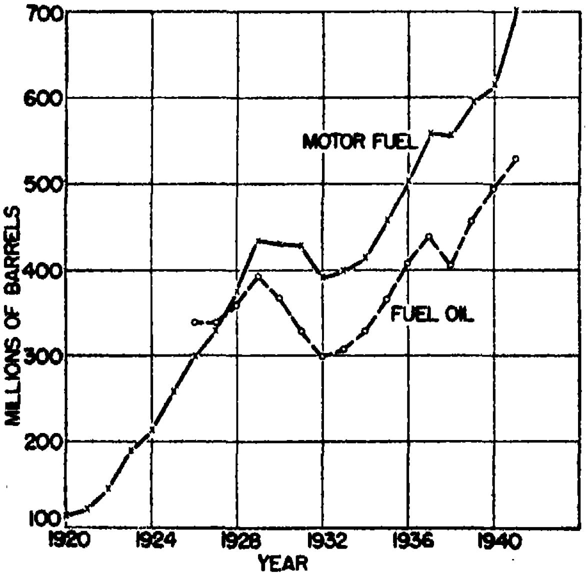


FIG. 5. Production of motor fuel and fuel oil (includes Diesel and other gas oil and distillates, and residual fuel oil, but not kerosene).

The four main classes of products shown in Fig. 2 add up to account for some 90 per cent. of the materials derived from crude oil. The group of products included in the classification "fuel oil" rank next to gasoline in volume. The growth in fuel oil production is illustrated in Fig. 5. Heating oil accounts for some 25 per cent. of the total fuel oil consumption;

[4] H. L. Ickes, "Fightin' Oil," New York, Alfred A. Knopf, 1943.

Domestic Oil Burner Installations

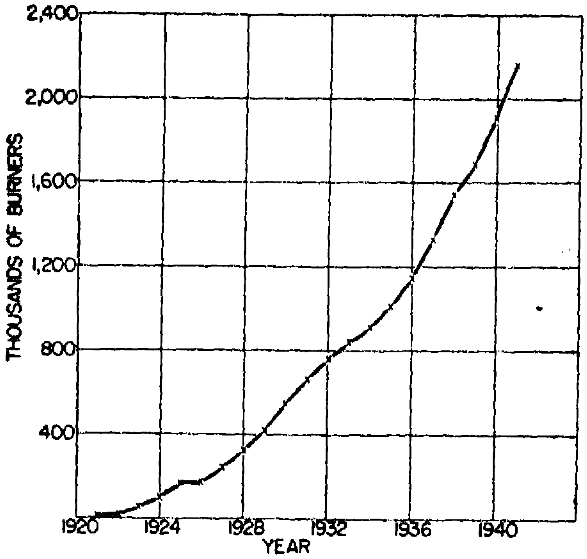


Fig. 6. Domestic oil burners installed at beginning of each year.

about two thirds of this is used for homes. How this outlet for petroleum has developed can best be seen from Fig. 6, which shows the growth in domestic oil burner installations. Although it may be easier to heat a house than to run an automobile with a substitute fuel, the millions of American families who are dependent upon petroleum for heating can also be counted on to have a genuine interest in the future of our oil supplies.

Production of Crude Oil in 1940

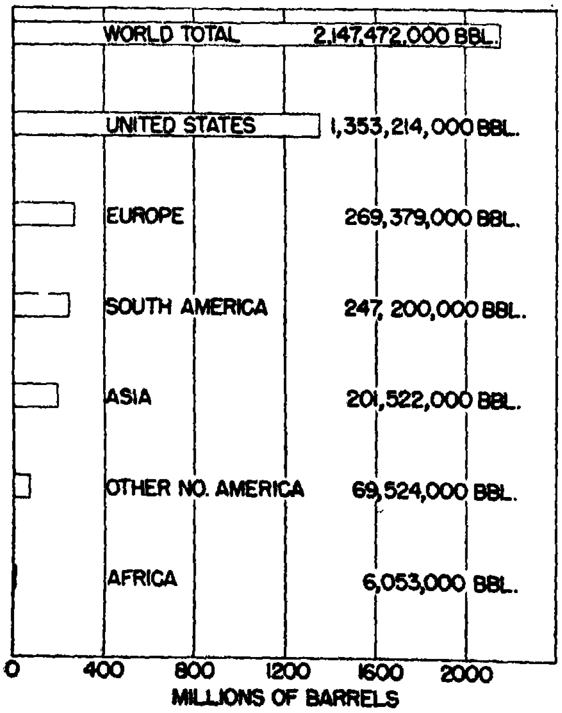


Fig. 7. Production of crude oil in 1940.

The position of the United States as a producer of crude oil is shown by Fig. 7. The data indicate that prior to the war we supplied some 63 per cent. of the world's petroleum requirements. At present the figure is higher. Although considerable crude from other sources is normally worked up in American-owned refineries located outside the United States, our actual import and export of crude are small in comparison with domestic production (Fig. 8). The volume of refined products imported has been about equal to that of the crude oil import, while the export of refined products has been running 20–40 per cent. higher than the figures for crude export during the period covered by Fig. 8. In other words, the United States production of crude oil has been in rather close balance with domestic requirements of petroleum products.

Crude Oil Production, Import and Export

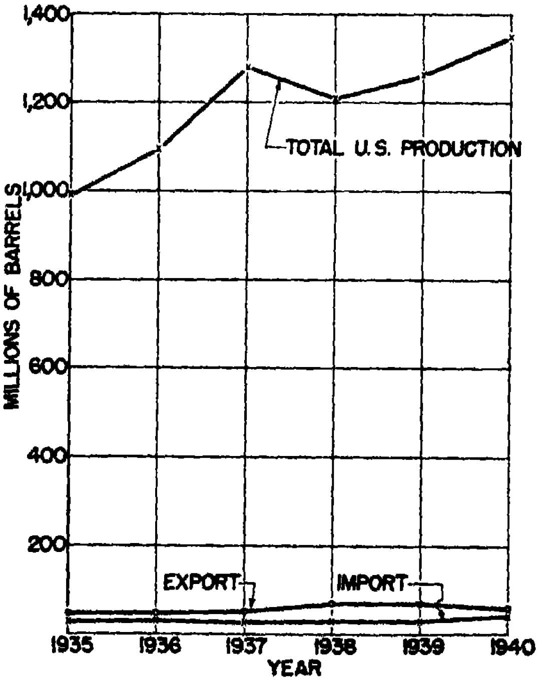


Fig. 8. United States crude oil production, import and export.

Fig. 9 gives the production and refining of petroleum by states. It is evident that there is considerable flexibility as far as the location of these two branches of the industry is concerned. Due to the ease with which crude oil can be transported by pipe line, tanker, barge and rail, the refining operations are not tied down to the place of production but can be carried out at points most suitable from the standpoint of distribution and/or consumption of the finished products.

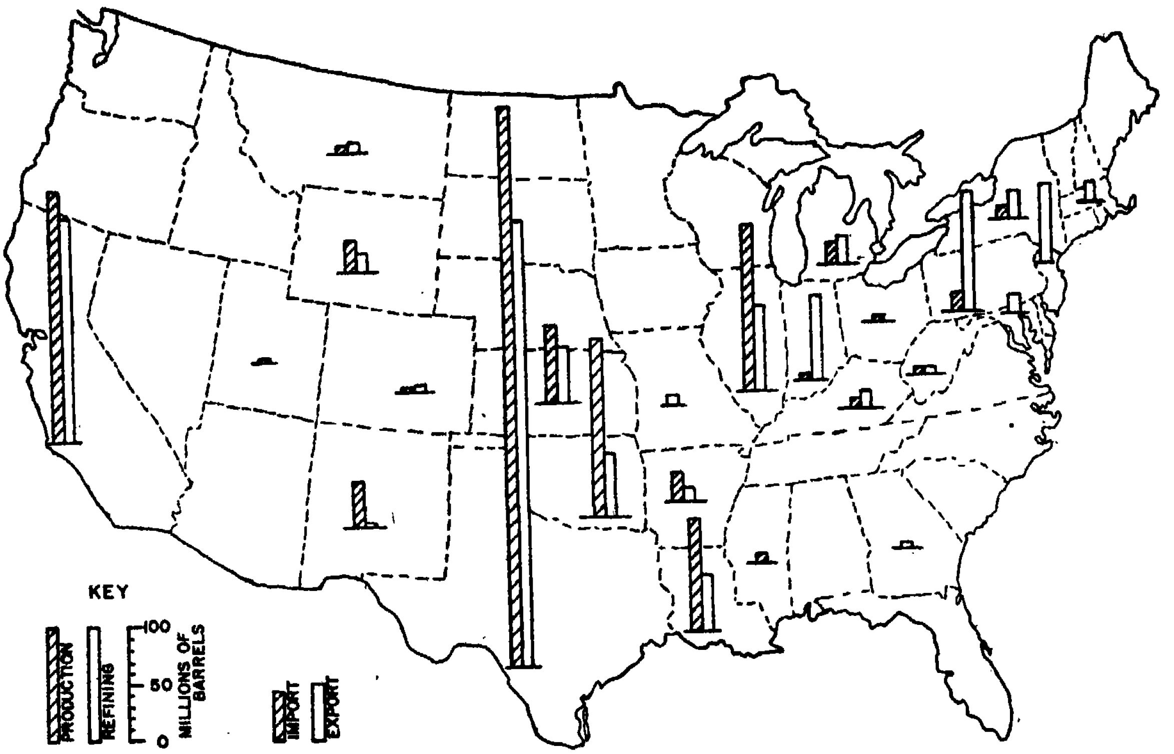


FIG. 9. Production and refining of petroleum by states.

The rate at which crude oil has been withdrawn from the ground is shown in Fig. 10 by the curve labeled "cumulative production." On the "cumulative, discovery" curve, the somewhat scattered points indicate the estimates made by various authorities at the time indicated. The vertical distance between the two curves represents the "proved reserves" at any one time. These are the oil reserves which, according to best estimates, are known to exist in the ground. As of July 1 of this year, the known and untapped reserves amounted to 20.4 billion barrels,[4a] or sufficient for perhaps fifteen years of our normal requirements. The proved reserves outside the United States are slightly greater, about 22 billion barrels. Of this oil located in other parts of the world, Britain controls about 50 per cent., America 25 to 30 per cent. and Russia around 20 per cent.[5]

The data in Fig. 10 show that, except for a period in the twenties when a shortage was seriously feared, the proved reserves have always kept ahead of production by a rather comfortable margin. However, only part of the growth in reserves shown is due to discovery of new fields; the remainder is made up of extensions to existing fields. As a new field is being developed by the drilling of additional wells, information is obtained which may lead to an upward revision of the originally estimated volume of oil present. This is what is meant by an extension to an existing field in

U. S. CRUDE PRODUCTION AND RESERVES

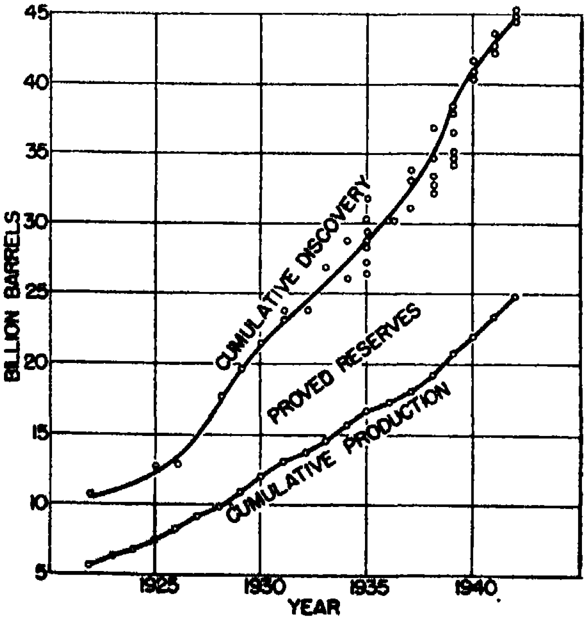


FIG. 10. Cumulative production and discovery of petroleum in the United States, adapted from Levorsen's data (*World Petroleum*, November, 37, 1942).

[4a] W. V. Howard, *Oil Gas Jour.*, July 28, 90, 1943.

[5] W. E. Pratt, "Oil in the Earth," Lawrence, Kans., University of Kansas Press, 1942.

contrast to the discovery of an entirely new field. The trend of actual discovery is brought out in Fig. 11, which shows the present estimates of the ultimate recoverable oil in the fields discovered each year since 1918. It is apparent that there has been a deficiency in new discoveries as compared with consumption of crude since 1939. It is this lag in the discovery of new petroleum reservoirs which now is the subject of so much discussion.

Normally the fifteen-year backlog of crude reserves would have given the petroleum industry the opportunity to work out its supply problem over an extended period. Except for the war, we would probably not have heard much about an impending crude shortage at this time. It is the necessity for providing the Allied forces with petroleum for a global war that has aggravated the situation.[6] Before attempting to explain why this is so, it may be well to see what is involved in the war requirements.

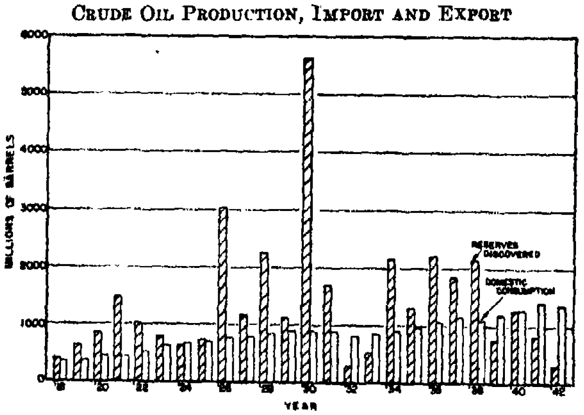


Fig. 11. Annual discoveries and consumption of petroleum, according to Heroy.[6]

In a recent report by W. R. Boyd, Jr., chairman of the Petroleum Industry War Council, mention is made of "the tremendous military demands for petroleum, which because of censorship have not been revealed to the oil industry, and already, exclusive of huge amounts of aviation gasoline and lubricants, are equivalent to about 25 per cent. of the total current production of crude oil in the United States. This demand has an even greater effect because the manufacture of special war products, particularly aviation gasoline, requires a disproportionate amount of the capacity for the manufacture of motor gasoline."[7] According to Petroleum Administrator Ickes, 60 per cent. (or nearly two out of every three tons) of the supplies sent overseas to our expeditionary forces over distances varying from 3,000 to 10,000 miles are oil.[4] Using President Roosevelt's figure of 1,110 gallons of fuel per bomber, a thousand-plane raid in the European theater of war consumes more than a million gallons of aviation fuel, or the equivalent of about one third of the cargo carried by a modern tanker. The situation is aptly described in Premier Stalin's toast at the time of Prime Minister Churchill's visit to Russia: "This is a war of engines and octanes. I drink to the American auto industry and the American oil industry." Or as Ickes has expressed it, ". . . the side than can throw the most oil into the fray over the longest period of time will win."[4]

To meet these requirements, the United States is now producing crude oil at the rate of more than 4,200,000 barrels a day. To illustrate what this figure means, we may observe in passing that it represents well over four times the production during the height of the World War in 1918. Only four to five days' production at that rate is needed to equal the annual prewar consumption of petroleum and related products in the whole of the Italian Empire with its population of 45,000,000.[8, 9] Less than ten days are required to equal the most recently estimated yearly production of crude in Rumania, which is the chief supplier of petroleum to the Axis powers.[10]

Large as current production is, it may at first sight appear strange that there is much of a drain on the reserves of some 20 billion barrels known to be in the ground. The explanation is that a "rate of withdrawal" factor is involved. To understand this problem fully, we must remember that crude oil occurs in the ground in porous rock, the permeability of which governs the physical rate at which the oil can be withdrawn. Also, oil contains no inherent energy, and it must therefore be displaced from the reservoir rock either by expanding gas associated with it or by water. In dealing with such a heterogeneous system, the efficiency with which the oil is displaced improves with reduced rate of withdrawal. Conversely, high rates of withdrawal result in inefficient flushing of the oil from the reservoir rock and consequent reduction in recovery. This imposes certain restrictions on the country's capacity for producing petroleum.

In other words, there is no immediate shortage of oil known to be in the ground. The problem confronting us is rather one of being able to withdraw this oil at the desired rate. In some fields, which are being operated on the best engineering principles, the natural gas is pumped back into the ground to aid in bringing still more oil to the surface; but in many older fields all or most of the gas has been withdrawn, leaving an inordinately high percentage of the original oil to be taken out of the ground by secondary recovery methods.

---

[6] W. B. Heroy, "Supply of Crude Petroleum within U. S.," statement in connection with Bill S. 1243, July 29, 1943.

[7] H. D. Ralph, *Oil and Gas Jour.*, July 22, 10, 1943.

[8] *Oil and Gas Jour.*, July 28, 86, 1943.

[9] *Oil and Gas Journal* (*l. c.*) gives the prewar petroleum requirements of Italy as less than 40,000 barrels daily; "Petroleum Facts and Figures" (13, page 18) mentions a somewhat higher figure of 21 million barrels a year as the Italian consumption in 1938 of petroleum and related products (motor benzol, alcohol, and synthetic fuels).

[10] *Ibid.*, August 5, 14, 1943.

Next comes the question of oil not yet discovered. It is difficult for any one to make a reliable estimate of the possible hidden reserves of crude. The viewpoint of the petroleum geologist is presented by Pratt,[5] who discusses the prospects of finding oil in terms of the subterranean structures and the efforts to explore these structures for their oil deposits. Of the crude so far discovered and developed world-wide, some 54 per cent. is accounted for by the search within the United States (Alaska not included). While this country constitutes only 5 per cent. of the land area of the earth, it contains 15 per cent. of the structural area most favorable for the occurrence of oil fields. If exploration by drilling is extended over this total area and if per acre yields equal to the average of the already proved areas are assumed, it would appear that the United States ultimately should give up at least 100 billion barrels of oil, including the 46 billion barrels which represent the total discovery (production plus reserves) to date. On the same basis, the rest of the world would ultimately produce some 600 billion barrels of oil, including the 38 billion barrels already found. Such considerations lead to the conclusion that "at the present rate of consumption the probable ultimate oil resources of the earth, made available and freely distributed, should meet humanity's needs for 300 years to come."

How to locate these potential oil reserves is a problem with so many technical and emonomic aspects that an adequate discussion can not be undertaken as part of this brief review. Not even those best qualified to have an opinion of this subject can predict how long new oil will continue to be brought in at the rate it is needed. This is the situation which has aroused so much recent comment and which logically leads to the question of where we stand with respect to alternate sources for the products now being obtained from petroleum.

(To be concluded)

OBITUARY

BARBARA STODDARD BURKS

THE death on May 24, 1943, of Dr. Barbara Stoddard Burks brought to a close the short career of a clear-visioned investigator who did much to emphasize the close relationship between the fields of psychology and genetics. Born in New York City in 1902, Dr. Burks received the A.B. and Ph.D. at Stanford University and was early identified with the psychological research in progress in California. In collaboration with Dr. Lewis M. Terman, she made a study of school children of outstanding intelligence, following their development through adolescence and finding them still superior in intelligence and achievement in later years. During her years in California, she began an extensive study of the children of parents with readily recognizable traits, such as alcoholism, comparing the development of those children reared by their own parents with those placed with foster parents. The results of this study helped to clarify the role of heredity in psychological development, while revealing the complexities of the situation. She made also a thorough and painstaking analysis of the intelligence, temperament and social adjustment of identical twins reared apart, following a number of such twins through many years of development, and concluding that heredity is of fundamental importance in determining the mental ability and temperament of the individual, while environmental differences play an important role in social adjustment. A well-trained and capable mathematician, Dr. Burks applied precise statistical criteria to her analyses.

In 1934, after the death of her husband, Dr. Burks went to Europe as a fellow of the General Education Board, and upon her return in 1936, she became a research associate at the Eugenics Record Office of the Carnegie Institution of Washington at Cold Spring Harbor, New York. Here she pursued for four years her interest in genetics in relation to physical and mental traits. She studied the inheritance and linkage of several mutations in man (ovoid red blood corpuscles, mid-digital hair and missing lateral incisors) and sought to establish a case of autosomal linkage. She also continued her studies of identical twins reared apart, making frequent trips across the continent to interview and test her cases. The high regard in which she was held by geneticists was evidenced by her appointment as chairman of a section meeting, that on abnormal human characters, at the Seventh International Congress of Genetics at Edinburgh in 1939, only one other woman, Dr. Kristine Bonnevie, being so honored.

In 1940, Dr. Burks became a research associate at Columbia University, collaborating with the State Charities Aid Association and the Social Science Research Council in a continuation of her foster-child studies. This work, left unfinished at her death, is being carried forward by Dr. Anne Roe. Dr. Burks was awarded a Guggenheim fellowship for the year 1943–44 for an extension of her study of identical twins, but her death occurred before the tenure of the fellowship began.

Dr. Burks was keenly interested in social problems and felt strongly the responsibility of the psychologist and geneticist in this respect. Her home was a center for thoughtful and constructive discussion of social issues by her scientific friends. She spent a vast amount of time and energy as chairman of the Committee on Aiding Displaced Foreign Psychologists of the American Psychological Association, and through her efforts many exiled scholars were placed in academic positions. She served also as editor of the *Bulletin* of the Society for the Psychological Study of Social Issues. She was an astute critic of scientific and social literature, and her lively book reviews were a constant source of enjoyment to her readers.

The pioneering work of Dr. Burks in demonstrating the relation between genetic characters and psychological traits, and in the application of advanced mathematical method to the analysis of psychological data established her as a scientist of high caliber, whose future contributions to her field of research were certain to be of great value had her life not ended so soon. To her colleagues and friends, her contagious enthusiasm for scientific investigation, her refreshing open-mindedness to the ideas of others, her genuine interest in those around her and the warmth of her friendship are irreplaceable.

KATHERINE S. BREHME

WELLESLEY COLLEGE

FREDERICK JOSEPH TAUSSIG

THE sudden death from pneumonia of Dr. Frederick J. Taussig on August 21, 1943, was felt in a keenly personal way by many people in different walks of life. They could scarcely believe the news because he had so recently, and in such high spirits, left for a well-earned vacation at Bar Harbor. Now it is realized, as never before, how much he has been giving to St. Louis and to the nation in kindly, unobstrusive but very direct ways.

Not only has he ushered into the world two generations of St. Louisans (1902–43), but these fortunate ones and their parents have enjoyed the feeling that he was their friend, always interested in them and ready to help whenever the occasion offered.

In Washington University School of Medicine, from which he graduated, in 1898, class after class of students has profited by his teaching for well over 30 years. Through these enthusiastic disciples his influence for good has spread far and wide.

A frequently mentioned characteristic of Dr. Taussig was his boundless energy. Teaching, and a large practice, of the kind in which he was called into service at all hours of the day and night, he took in his stride, ever cheerful, never apparently unduly hurried. By some miracle, he also found time to direct the medical activities of two great institutions, the Barnard Free Skin and Cancer Hospital in St. Louis and the State Cancer Hospital at Columbia. His directness, understanding of human nature and sense of humor made an almost unbeatable combination.

Numerous publications bear witness to his wisdom and industry, of which, perhaps, the most significant is his book, "Abortion, Spontaneous and Induced; Medical and Social Aspects," a classic recognized everywhere by medical men and sociologists alike.

Dr. Taussig communicated his zeal for research to others. An effective way promptly to bring a conference with most scientists to a close is to speak about one's own work, not theirs. Not so with him. He was always interested in every serious effort to advance knowledge. The secret of the marvelous manner in which Dr. Taussig remained so characteristically young to the last may have been his quick forgetfulness of self and the resolute way in which he looked ever to the future.

E. V. COWDRY

WASHINGTON UNIVERSITY SCHOOL
OF MEDICINE

RECENT DEATHS

A CORRESPONDENT writes: "Professor Oscar M. Morris, professor of horticulture and horticulturist in the Agricultural Experiment Stations of the State College of Washington, recognized as a national authority in the field of pomology, died at his desk on November 13 at the age of sixty-nine years. He joined the staff of the State College of Washington in 1910, and was head of the department of horticulture from 1911 to 1927. He began collegiate teaching on the staff of his alma mater, Oklahoma Agricultural and Mechanical College, in 1898, and was advanced there to a professorship of horticulture and horticulturist. He was a member of the American Pomological Society, the American Society for Horticultural Science, Phi Kappa Phi and Alpha Zeta."

THE death at the age of seventy-six years is announced of Alfred Vivian, emeritus dean of agriculture of the Ohio State University.

DR. E. P. CLARK, for the past fourteen years senior organic chemist in the Division of Insecticide Investigations of the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture, died on November 7.

JOHN W. STACEY, research associate in botany in the California Academy of Sciences, a well-known distributor and publisher of books on biology and medicine, died in San Francisco on October 16 at the age of seventy-two years.

SIR EDWARD BAGNALL POULTON, until his retirement in 1933 Hope professor of zoology at the University of Oxford, died on November 21 at the age of eighty-seven years.

ACCORDING to a Reuter message from New Delhi, Sir Aurel Stein, the Asiatic explorer, died on October 26 at the age of eighty-one years.

SCIENTIFIC EVENTS

BRITISH VITAL STATISTICS

IN the foreword to the Summary Report of his department for the year ended March 31, Ernest Brown, British Minister of Health, states that in many ways the year was a notable one, remarkable, among other things, for a series of favorable records in vital statistics, and for an increase at the same time in short-term sickness. He writes:

> There can be no doubt that the nation's prodigious war effort has imposed a severe strain upon the health of the people—a strain which they have in general withstood with dogged determination and astonishing success. So far as we can, we have made ready to meet any attack that disease may make. . . . But, as has often been emphasized, the strains of war are progressive, and their effects on health may be long-term. Certainly in the fifth winter of war, we must not relax our watchfulness or reduce our activity.

The report, according to *The Times*, London, states that the year was a record-breaking one in vital statistics, apart from the black spots in venereal disease and tuberculosis. Maternal and infant mortality rates and the standardized death rates among civilians, male and female, were the lowest ever recorded in England and Wales, and the incidence of infectious diseases was remarkably low, probably the best on record. Inquiries among doctors and rising claims to sickness benefit under the national health insurance scheme suggested a considerable increase in short-term sickness, but an increase in minor ailments might well be expected after more than three years of war.

Deaths in England and Wales in 1942, including registered non-civilian deaths and those due to enemy action, numbered 480,137, or 55,043 less than in 1941, the general death-rate among civilians being remarkably low. Among females the standardized rate was 6.84 per 1,000 living, or 8 per cent. better than in any previous year, notwithstanding the inclusion of deaths in this country from enemy action and the withdrawal of large numbers of healthy young women from the civilian population. Among civilian males the standardized rate of 9.52 was also the lowest recorded, in spite of the considerable effect of selective recruitment. Mortality of children at the pre-school ages of one to five, which had declined by no less than 47 per cent. between 1931–35 and 1939, showed a further improvement of two per cent. in 1942; and at the school ages of five to 15 the low level reached in 1939 was regained.

Live births, 654,039, increased by 66,811, and, after allowing for deaths, there was a natural increase of 173,902, the rate of 15.8 per 1,000 being the highest since 1931.

The report points out that the number of houses repaired up to March 31 was 2,500,000, and well over 1,000,000 had received more extensive repairs. The housing position, however, is serious, and "a vast amount of work is required to bring housing conditions up even to the standard of 1939, a standard by no means as high as that aimed at before the war broke out."

THE HOOKER SCIENTIFIC LIBRARY

A BRANCH of the Hooker Scientific Library was opened on November 1, 1942, at Wayne University, Detroit, by Dr. Neil E. Gordon, chairman of the department of chemistry. The object of this branch is to help the library to continue the service which was started at Central College in October, 1939. The demand for translations, searches, abstracting and photocopying became so large that a plan was formulated to develop in Detroit a complete modern chemical library. The sum of $200,000 has been raised by subscription from foundations, chemical industries and individuals, $100,000 to be used for the purchase of the library and $100,000 for modernizing and adding to it.

Contributions are conditional upon the acceptance of the following responsibilities by Wayne University—maintenance and development of the collection; a staff sufficient to make the library useful to chemists; space for housing and service; and maintenance of a chemical technology service covering translations in fifteen languages, searches, consultation and photoreproduction.

Dr. Gordon announces that the acquisition of the library for Wayne University has been assured by a grant of $100,000 toward its purchase by the Kresge Foundation. The other $100,000 is being contributed by the American Association for the Advancement of Science, the local section of the American Chemical Society, the Barnes, Gibson and Raymond, Burroughs Adding Machine Company, the Chrysler Corporation, Carboloy Company, Inc., Difco Laboratories, Inc., the Detroit Edison Company, the Ethyl Corporation, Eberbach and Company, the Federal Mogul Corporation, the Gelatin Products Company, the General Motors Corporation, the Hercules Powder Company, Mrs. Icie Macy Hoobler, Dr. and Mrs. Sibley Hoobler, the McLouth Steel Corporation, the Miner Estate,

R. E. Marce, the Murray Corporation of America, the Neilson Chemical Company, Parke, Davis and Company, Wyandotte Chemical Company, the W. R. Warner Company, the White Star Gasoline, the U. S. Rubber Company and the Udylite Corporation.

There will be connected with the library courses for the training of specialists in chemical literature. Candidates for this training will be encouraged to enter the graduate school for advanced degrees. The library will be known as the Kresge-Hooker Scientific Library.

THE AMERICAN ORNITHOLOGISTS' UNION

THE sixty-first annual meeting of the American Ornithologists' Union was held at the American Museum of Natural History, New York City, on October 20.

Due to travel restrictions, the usual five-day meeting with program sessions was dispensed with, all activities being condensed into a streamlined one-day business session to meet requirements of the by-laws and incorporation rules. Fifteen members of the council, 19 fellows and 11 members were present. On Wednesday evening the group was entertained at the University Club by Dr. Leonard O. Sanford, of New Haven, Conn.

Officers elected for the new year were as follows: *President,* James L. Peters, New York City; *Vice-presidents,* George Willett, Los Angeles, and Hoyes Lloyd, Ottawa; *Secretary,* Lawrence E. Hicks, Columbus; *Treasurer,* J. Fletcher Street, Philadelphia; *Editor,* John T. Zimmer, New York City; *New Members of the Council,* Dr. Harry C. Oberholser, Cleveland; Ludlow Griscom, Boston, and Dr. Alden H. Miller, Berkeley.

The Brewster Medal Award was made to Dr. Alden H. Miller, of Berkeley, Calif., for his publication on "Speciation in the Avian Genus Junco." Two fellows were elected: Dr. S. Charles Kendeigh, Champaign, Ill., and Austin L. Rand, Ottawa.

In addition to 155 new associate members, five new members were named: Dean Amadon, New York City; Robert J. Niedrach, Denver; Frank A. Pitelka, Berkeley; Julian K. Potter, Collingswood, N. J., and Terence M. Shortt, Winnipeg.

The meeting in 1944, if conditions permit, will probably be held in New York City, in October.

LAWRENCE E. HICKS, *Secretary*
THE OHIO STATE UNIVERSITY

THE HISTORY OF SCIENCE SOCIETY

A JOINT session of the History of Science Society with the American Historical Association will be held at Barnard College, Columbia University, on December 29 and 30. The program follows:

FIRST SESSION

Dr. L. C. Karpinski, *presiding*
Conference on Latin American History

Mathematics in Latin America, a brief survey of their publications, Dr. L. C. Karpinski, president, History of Science Society, University of Michigan.

The History of Medical and Bacteriological Sciences in South America, Dr. Aristides A. Moll, secretary of the Pan American Sanitary Bureau, Washington, D. C.

Learned Societies in Latin America, Dr. Arthur P. Whitaker, University of Pennsylvania and State Department, Washington, D. C.

SECOND SESSION

Dr. Arthur P. Whitaker, *presiding*

Alexander von Humboldt as Historian of Science in Latin America, Dr. C. A. Browne, Bureau of Chemistry and Soils, U. S. Department of Agriculture.

The Contribution of the Jesuits to the Exploration and Anthropology of South America, Dr. Alfred Metraux, anthropologist, Bureau of American Ethnology, Smithsonian Institution.

The Impact of the Fauna and Flora of the New World upon the Old World during the Sixteenth Century, Dr. Arthur S. Aiton, professor of Hispanic-American History, University of Michigan.

ALEXANDER POGO, *Secretary*

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

THE sixty-fourth annual meeting of the American Society of Mechanical Engineers, under the presidency of Harold V. Coes, will be held at the Hotel Pennsylvania, New York, beginning on Monday, November 29, and concluding on December 4.

The program includes about a hundred and fifty papers, addresses, panel discussions and symposia. It is built around the eighteen professional divisions of the society—applied mechanics, aviation, fuels, graphic arts, heat transfer, hydraulic management, materials handling, metals engineering, oil and gas power, petroleum, power, process industries, production engineering, railroad, textile, wood industries, rubber and plastics.

On the opening day, speakers at a luncheon on "ingenuity" will be Dr. Charles F. Kettering, director of research of the General Motors Corporation, and Dr. Vannevar Bush, director of the Office of Scientific Research and Development and president of the Carnegie Institution of Washington. An evening session on ingenuity will include papers on "The Psychological Setting for Inventiveness," by Elliott Dunlap Smith, professor of economics at Yale University; "What Our Educational Institutions Can Do for the Genius," by Dr. Henry T. Heald, president of the Illinois Institute of Technology, and "Yankee Ingenuity in Engineering," by W. L. Merrill, head of the Works

Laboratory of the General Electric Company at Schenectady.

Tuesday afternoon's program will include a session on postwar planning. The speakers will be John F. Fennelly, executive director of the Committee for Economic Development; Paul G. Hoffman, chairman of the Committee for Economic Development and president of the Studebaker Corporation, and W. C. Schroeder, assistant chief of the Fuels and Explosives Service, Bureau of Mines, Washington, D. C. The Tuesday night sessions will include a paper on "Principles of Air Cargo Design," by A. Klemin, of New York University; a symposium on "War-Time Problems of Industrial-Instrument Departments"; a production research panel on "What Most Needs to be Done in the Way of Production Research at This Time," and a panel discussion on "Accelerating Scientific Management in the Federal Government" with the following discussion leaders: Arthur S. Flemming, commissioner, U. S. Civil Service Commission; W. A. Jump, director of finance, U. S. Department of Agriculture; J. M. Juran, administrator, Office of Lend-Lease Administration; and L. A. Appley, deputy chairman and executive director, War Manpower Commission.

At the luncheon of the aviation division on Wednesday, Colonel Nathaniel F. Silsbee, U. S. A., Air Information Section of the Bureau of Public Relations, will be the principal speaker. At the dinner in the evening Harold V. Coes, president of the association, will speak on "Wartime Research and Development—A Molder of Engineering," and Ralph Damon, vice-president and general manager of the American Air-lines, Inc., will give an address on "Aviation; During and After the War." The annual awards and honors will be conferred.

On Thursday, there will be luncheons of the railroad and of the textile divisions and the programs will include papers on railroad equipment in the post-war period. The evening session will include a program on biomechanics and on Friday there will be papers on textiles.

In connection with the meeting, Leo T. Crowley, Alien Property Custodian of the United States Government, has announced that an exhibit of some 45,000 copies of vested U. S. patents and patent applications will be shown and representatives of the custodian's office will be present to answer questions concerning these inventions and the licensing policy of the custodian. These patents and patent applications in the mechanical, electrical and chemical fields were formerly enemy-owned or enemy-controlled, but are now controlled by the Alien Property Custodian.

DECLARATION OF CITIZENS OF ARGENTINA

WE have received from Dr. Robert A. Lambert, associate director of the Rockefeller Foundation, a "declaration" published on October 13 and signed by a hundred and fifty eminent Argentine citizens, including South America's greatest scientist, Bernardo A. Houssay, and the government's reply dismissing all signers who held official positions. This means that the professors of physiology in the three leading medical schools, Houssay (Buenos Aires), J. T. Lewis (Rosario) and Oscar Orias (Cordoba) are out, along with a number of other distinguished university teachers.

A DECLARATION OF EFFECTIVE DEMOCRACY AND AMERICAN SOLIDARITY FORMULATED BY A GROUP OF THE COUNTRY'S REPRESENTATIVE CITIZENS

In order to express their opinion on the fundamental problems of the day and the solution which in their opinion is demanded, representative citizens of the federal capital, Rosario, Córdoba and La Plata, have resolved to sign the declaration which we herewith publish.

Among the signers figure men of outstanding action in the universities, finance, commerce, industry, journalism, letters and arts, scholastic centers and workers' syndicates, together with former ministers of state, ambassadors, legislators and heads of political parties such as the Civic Radical Union, Socialist, National Democrat, Progressive Democrat and Antipersonalist.

The document in question follows:

"We, the undersigned citizens of the present declaration, belonging to various walks of the national life, consider that at this present moment of the nation's history it is imperative and urgent to express the fundamental solution demanded by the vast majority of the people and which constitutes at the same time the basis for insuring union, peace and the future of the Argentinians.

"We sum up this resolution in the following terms: effective democracy through the faithful application of all the stipulations of the National Constitution and American solidarity through the loyal fulfilment of the international commitments signed by the representatives of the country. Argentina can not and should not apply only a part of her Constitution and live isolated or estranged from her brother peoples of America and from those of the world fighting for democracy. We also hold that the freedom of assembly and of the press—most essential within our institutional regimen—would afford opportunity for public opinion to ratify in decisive form the basic concepts here set forth.

"We deem it indispensable to further the realization of this national desire and hope that the citizens who share our aims will advise us of their adherence through any of the undersigners, believers in the motto: Effective democracy and American solidarity."

The President Orders the Dismissal of Those Signing a Manifesto

The Measure Took Effect on October 16 and Includes Officials and Teachers Paid or Otherwise

Buenos Aires, October 16, 1943. The Secretary of the Nation's President, Colonel Don Enrique P. González, has this day sent to the secretaries of state in the various ministries the following memorandum:

"To the Minister: On behalf of His Excellency the President, I have the honor to address Your Excellency to inform you that His Excellency has resolved that as of this day's date the signers of a manifesto which appeared in yesterday's papers, a copy of which I enclose, and which contains declarations incompatible with the honorable discharge of public duty, be declared dismissed from the national administration or any of its dependents. This decision of the government includes all those who hold public office or official positions, whether paid or honorary and of whatever nature.

"As you certainly can not fail to realize, it is not permissible for officials or employees of the state, who are obliged to set an example of respect and loyalty, to arrogate to themselves powers which conflict with administrative ethics and public morals. Nor is it acceptable that officials or employees of the state aspire to rectify, by means of collective and extraordinary declarations, a government to which they are subject and whose laws, decrees and regulations they are bound to obey. Nor can it be tolerated that they share and strengthen concepts held by militant politicians. All the above disturbs the general peace, which must be maintained at whatever cost.

"Officials and employees of the state should be fully aware of their duties, and when they forget them it is necessary to suppress the disobedience and to remind each one clearly of his position.

With my kind regards."

Dismissals in the Municipality

The Municipal Administration yesterday issued a communication to the following effect:

In accordance with the decree of the President of the Nation, General Don Pedro Pablo Ramírez, as of this date the municipal administrator, General Don Basilio B. Pertiné, issued a decree calling for the dismissal of those municipal employees who signed the manifesto which appeared in the papers of the 15th instant and which contains declarations incompatible with the honorable discharge of public duty.

—*From the Spanish*
ESH, November 3, 1943

SCIENTIFIC NOTES AND NEWS

The American section of the Society of Chemical Industry has awarded the Perkin Medal to Gaston F. DuBois, vice-president of the Monsanto Chemical Company, St. Louis, "in recognition of his outstanding work in applied chemistry." The presentation will be made at a dinner meeting of the society which will take place on January 7 at the Hotel Commodore, New York City.

Dr. William Hovgaard, professor emeritus of naval construction at the Massachusetts Institute of Technology, received on November 12 the David W. Taylor Medal, the highest award of the Society of Naval Architects and Marine Engineers, in recognition of "outstanding achievement in naval architecture." The presentation was made at the annual dinner, which was given at the close of the two-day golden anniversary meeting of the society.

Orville Wright will be the guest of honor on December 17 at a dinner in Washington to commemorate the fortieth anniversary of the first successful airplane flight of the Wright brothers at Kitty Hawk, N. C. The invitation was extended by President Roosevelt at the request of an anniversary committee headed by Secretary of Commerce Jesse Jones.

Professor J. L. Synge, of the Ohio State University, has been awarded the Henry Marshall Tory Medal of the Royal Society of Canada "for achievement in scientific research." Dr. Synge was formerly professor of applied mathematics at the University of Toronto.

Sir Harold Spencer Jones, Astronomer Royal of England, has been elected an honorary member of the American Astronomical Society.

Dr. Ernest B. Babcock, professor of genetics and geneticist in the Agricultural Experiment Station of the University of California at Berkeley, was appointed at a recent meeting of the Northern Branch of the Academic Senate to give the next annual faculty research lecture.

Professor George Granger Brown, head of the department of chemical and metallurgical engineering of the University of Michigan, was elected president of the American Institute of Chemical Engineers at the recent Pittsburgh meeting. He succeeds J. L. Bennett, manager of chemical operations in the explosives department of the Hercules Company. Dr. L. W. Bass, director of the New England Industrial Research Foundation, Boston, formerly assistant director of the Mellon Institute, Pittsburgh, was elected vice-president.

Chester Alan Fulton, president of the Southern Phosphate Corporation of Baltimore, has been elected president of the American Institute of Mining and Metallurgical Engineers. John L. Christie, of Handy and Harmon, and J. Robert Van Pelt, Jr., geologist and technical director of the Chicago Museum of Science and Industry, have been elected vice-presidents.

The initiation of students into the Smith Chapter of the Society of Sigma Xi took place at a dinner on November 18 at which Dr. Donald H. McLaughlin, director and vice-president of the Cerro de Pasco Copper Corporation, was the guest of honor. The following new officers of the chapter were installed: *President,* Dr. A. T. Jones; *President-elect,* Dr. A. F. Blakeslee; *Secretary,* Miss Helen Stobbe, and *Treasurer,* Dr. Elinor V. Smith. Dr. McLaughlin gave a public lecture on the Peruvian Andes, illustrated with kodachrome slides.

Dr. Maxim K. Elias, of the University of Nebraska, since 1939 research paleontologist of the Nebraska Geological Survey, has been promoted to a full professorship.

Dr. Harland G. Wood, formerly assistant research professor of bacteriology at Iowa State College, has been appointed associate professor of physiological chemistry at the University of Minnesota. He will be responsible for work on the biochemical aspects of the virus-host relationship in poliomyelitis, a research sponsored by the National Foundation for Infantile Paralysis.

Dr. George Finlay Simmons, from 1934 to 1943 professor of zoology at Montana State University, has been appointed assistant professor of anatomy in the School of Medicine of Loyola University at the Chicago Medical Center; he will be associated in the teaching of microscopic anatomy with Dr. R. M. Strong, head of the department of anatomy.

Dr. James H. Carter, of the Iowa State College, has become professor of chemistry at Madison College, Harrisonburg, Va.

Professor A. L. McComb, of the department of forestry of Iowa State College, has joined the Office of Economic Warfare, to study the development of cinchona trees in Colombia. He has been granted leave of absence for the duration of the war. Professor A. G. Norman, of the department of agronomy, also has leave of absence to enter the war research service of the National Academy of Sciences.

Professor H. T. U. Smith, of the department of geology of the University of Kansas, has leave of absence to enable him to accept a war-service appointment in Washington, D. C., as geologist of the U. S. Geological Survey.

William Fred Danner, research assistant in the department of biochemistry of the University of Wisconsin, has become research assistant in the Atmospheric Nitrogen Division of the Solvay Process Company, Syracuse, N. Y.

Chemical and Engineering News states that John A. Hutcheson has been appointed director of the Westinghouse Research Laboratories at East Pittsburgh, Pa. He was formerly manager of the radio division at Baltimore.

Dr. William C. Herrold, assistant chief of the meat inspection division of the U. S. Department of Agriculture, will retire on November 15 after thirty-five years in government service. He will become associated with the Ohio State Department of Health.

Dr. George Boas, professor of the history of philosophy at the Johns Hopkins University, has received leave of absence to accept a lieutenant commander's commission in the Naval Reserve.

Charles L. San Clemente, who has been research immuno-chemist at the Institute of Pathology of the Medical School of Western Reserve University, has become a second lieutenant in the Sanitary Corps. He is stationed at Carlisle Barracks, Pennsylvania.

Dr. Sumner C. Brooks, professor of zoology at the University of California at Berkeley, and Dr. Matilda M. Brooks, research associate in biology, have left for a lecture tour of the main university centers of South America, under the auspices of the Committee of Inter-American Artistic and Intellectual Relations.

Dr. William W. Frye, associate professor of preventive medicine and public health in the School of Medicine of Vanderbilt University, returned early in September from a six-weeks' study of tropical diseases in Central America. The program was developed by the Association of American Medical Colleges at the request of the Surgeons General of the Army and Navy in an attempt to improve the teaching of tropical medicine in the medical schools of the United States and Canada. The program was supported financially by the John and Mary R. Markle Foundation and sponsored in Central America by the Pan American Sanitary Bureau, the Office of Coordinator of Inter-American Affairs and the United Fruit Company.

Frank Rayns, Norfolk County organizer of agricultural education and director of the Sprowston Experimental Station, England, will make a three-months' visit to the United States, arriving late in November. He plans to visit agricultural experiment stations and educational institutions having departments of agriculture.

Sir Gerald Campbell, British Minister and special assistant to the British Ambassador, delivered on November 18 the first in this year's series of laity lectures of the New York Academy of Medicine. His lecture was entitled "The Effects of Science upon Human Beings."

THE three hundred and ninety-ninth meeting of the American Mathematical Society was held at Columbia University on October 30. An address was given by Professor W. T. Martin, of Syracuse University, entitled "Mappings by Means of Systems of Analytic Functions of Several Complex Variables." Twenty-two research papers were presented. It was voted to approve the establishment of another series of publications, entitled "Mathematical Surveys," to consist of brief but detailed expositions of certain problems or portions of fields of particular interest in current research.

THE botanical library of Dr. Charles C. Deam, of Bluffton, Ind., has been purchased by Indiana University and will soon be moved to Bloomington and housed with the Deam Herbarium, which was purchased by the university a few years ago. The library consists of about 3,500 bound volumes and numerous pamphlets and reprints, including complete sets of several periodicals and many rare works on the botany and on the history of Indiana and the Middle West.

BY the will of Mrs. Ines Stross, widow of Ludwig Stross, the sum of $121,298 is bequeathed to educational and charitable institutions. Bequests of $30,000 each were left to Columbia, Princeton and Harvard Universities. It is also directed that the residuary estate be used for educational and charitable purposes.

THE American Psychological Association has made an appropriation of $10,000 to the National Research Council for the support of the Office of Psychological Personnel for the calendar year 1944, to be expended by the treasurer according to a budget approved by the council. It is understood that any unexpended balance as of December 31, 1944, shall revert to the Psychological Association.

THE Museum of Natural History, San Diego, according to *Museum News*, has received from Mrs. Harry M. Wegeforth a collection of about 50,000 shells from all over the world, collected by the late Captain J. F. Anderson and his wife. Captain Anderson bequeathed the collection to Dr. Wegeforth, who was an officer of the San Diego Society of Natural History until his death in 1941.

THE following resolution was passed unanimously by the Conference of Southern Graduate Schools at their meeting in Atlanta on October 19: "As representatives of southern graduate schools, we wish to offer our services in the post-war program of higher education. We are equipped to provide and direct mature professional training, notably in the research necessary for the continuation of industry, government, science and education. We urge that our facilities be made available to properly prepared men and women on the same terms on which governmental aid in education may be afforded to undergraduate students. We hope that these terms will leave the student free in selecting his graduate school. We hope further that the graduate schools will be left completely free to organize and administer their courses of instruction."

A REPORT on "Scientific Research and the Universities in Post-war Britain," drawn up by a sub-committee of the Parliamentary and Scientific Committee and approved by the committee itself, according to *The Times*, London, urges a proportional expansion of the supply of scientific workers. The report points out that this in turn calls for an expansion of the universities and technical colleges and an all-round improvement in the teaching of science and scientific principles at all stages of education. The universities are recommended to prepare for a rapid growth in the number of students of science and technology, that consequently state bursaries and engineering cadetships should be continued and developed to cover the biological, medical, veterinary and agricultural sciences. The committee also proposes that university staffs, stipends and buildings should be increased, and estimates that £10,000,000 will be required for buildings and equipment spread over the first five years after the war. It is also recommended that the present annual treasury grant to the universities of approximately £2,250,000 a year should be increased to £6,000,000 or £7,000,000. To ensure the best use of the increased funds and to avoid overlapping, it is proposed that the universities should set up a suitable advisory council. Increased facilities for part-time technical study and training and greater assistance to young people already engaged in industry to enable them to take full- or part-time courses are also urged.

DISCUSSION

MENTAL MALADJUSTMENT AND COLOR VISION

THE number of cases of parachromopsia (so-called "color-blindness"), in which there is an obvious history of dietary insufficiency, especially a lack of meat in the diet, has recently suggested to us a possible relation to maladjustment of the neurotic type. We have long known that neurotic stammerers are usually non-meat-eaters. Some of them were brought up in childhood on the vicious diet of "cereals and strained vegetables," and never acquired a taste or a tolerance for meat. Whether this could be ascribed to a protein lack, or whether there is some other feature of meat which is important for nervous stability is a question which is not important for present purposes.

We do not think that all cases of color-blindness have a dietary basis, or that there is any single condition which produces color-blindness. In fact, we know that cases of toxic origin, as through the inhalation of wood alcohol vapors from varnish over a considerable period of time, are not changed by administration of vitamin A. The similarity of the conditions in many cases of color-blindness to the conditions in many cases of maladjustment, suggested, however, that it would be well to subject persons suffering from neurotic maladjustment to test of color vision.

So far, I and my assistants have tested only twelve cases. Some of these have been under psychological treatment and some have been examined, but not treated, for various reasons. This meager list of cases is presented primarily to call attention to the possibilities; but they illustrate some of the dangerous factors involved in dependence on chart tests for color vision.

The tests used were the Ishihara and Dr. Loken's revision of the Nela test, which consists of 24 items. In the epitome below, M. indicates male, and F., female. *Ish* designates the Ishihara test, in which the charts which persons with normal color vision are supposed to read are indicated by *N*, and the charts which "normals" are supposed not to be able to read are designated by *An*. The *An* entry "partly read" means that one or more of the *An* charts were not read exactly as the color-blind are supposed to read them. We understand that such anomalies are commonly ignored by those who administer the chart tests; but our cases should make it obvious that if a chart test is to be taken seriously, even part-reading of an *An* chart by any person indicates that he should be thoroughly examined by practical tests. The epitome of cases follows.

1. M. Complex mental condition; organic trouble suspected. Sent to a physician for diagnosis.
Ish; N, all read; *An*, none read. *Nela;* six errors, but long study of a number of items finally judged correctly.
2. F. Diagnosed as epileptic; but certainly neurotic.
Ish; N, all read; *An*, all read. *Nela;* 14 errors.
3. F. Worried about going insane; other neurotic symptoms.
Ish; N, one digit wrong in one chart; *An*, none read. *Nela;* 8 errors.
4. M. Stammerer, under treatment and now approaching normal speech.
Ish; N, all read; *An*, none read. *Nela;* no errors.
5. F. Neurotic; subject to giddy spells.
Ish; N; one digit wrong in one chart; *An*, partly read. *Nela;* 4 errors.
6. M. Stammerer; not yet treated.
Ish; N; 4 charts not read; *An*, none read. *Nela;* 8 errors.
7. M. Neurotic; worrying type; family tensions.
Ish; N, one digit wrong in one chart; *An*, partly read. *Nela;* 5 errors.
8. M. Neurotic; colon ulcers; family tensions.
Ish; N, one digit wrong in one chart; *An*, partly read. *Nela;* 16 errors.
9. M. Stammerer; poor physical condition; non-meat-eater.
Ish; N, all read; *An*, partly read, *Nela;* 16 errors.
10. M. Poor physical condition; non-meat-eater.
Ish; N, one digit wrong in one chart; *An*, Partly read. *Nela;* 16 errors.
11. M. Stammerer; bad physical condition; exophoria.
Ish; N, all read; *N*, partly read. *Nela;* 7 errors.
12. M. Paranoid type; delusions.
Ish; N, all read; *An*, partly read, *Nela;* 18 wrong.

Cases 1 to 10 are of ages from 18 to 21. Cases 11 and 12 are somewhat older.

Twelve cases of course can not prove a point; but the fact that of the twelve only one is completely normal in color-vision, suggests a possibility which should receive attention through the examination of a large number of cases. Whether these cases are exceptional, or representative, is a question which can be settled only by extensive testing of maladjusted persons, whether they are classified as "neurotic," "schizophrenic" or otherwise.

We do not mean to suggest that any considerable fraction of the large class of color-blind men and women are mentally maladjusted. The possibility we have in mind is that a substantial proportion of those who are maladjusted are color-blind; which is another proposition.

Aside from the main point of interest, these twelve cases serve to illustrate a fact which we have found in the past, namely; that many persons who "pass" the chart tests are, nevertheless, parachromopsic, and many of them seriously so. If, as Murray[1] and Elder[2] contend, color discrimination is so very important for men in the armed services, the present dependence on chart tests is extremely dangerous. That color discrimination, as measured by tests which depend on the detection of similarities and differences of critical colors, fills the needs of the services is, however, open to question. The Nela test detects parachromopsia of varying degrees, but that does not indicate that it is sufficient or even necessary for selection of personnel. The chart tests, as we have earlier pointed out,[3] do not even test color-discrimination, since the reading of the charts depends, not on color differences, but merely on brightness differences.

---

[1] SCIENCE, November 13, 1942.
[2] SCIENCE, June 18, 1943.
[3] SCIENCE, September 11, 1942.

For the armed services the requirement is not color-discrimination, but identification of colors, which is a different matter. Many persons who are parachromopsic have learned properly to identify significant colors. They do not see the colors as do persons of normal color vision, but the colors have the same significance for them as for those who are normal in color vision. A typical case is that of a signal man who had done his work satisfactorily, having no difficulty in identifying the flag colors, but who was eventually found to be color-blind, and was transferred from the signal corps.

The notion that color-blind drivers have more difficulty in identifying the red, yellow and green traffic lights than do drivers with normal color-vision, is without foundation. On the other hand, many persons who have normal color vision, as determined by the best tests, are quite inaccurate in their identification of colors seen singly. Some of the worst casualties in railroad history have been caused by engineers (presumably not color-blind) running through red stop signals. In less critical situations, failure properly to identify colors is not uncommon among persons who are not parachromopsic.

A further defect of all present tests of color vision is that they are administered at close range; usually at ordinary reading distance. Requirements in the service, however, are for identification of colors at varying distance; often at great distance. Distance, of course, changes the size of the retinal image, and this is a matter of importance. Image size, however, may not be the only important factor, for vision is a highly complex process. It is quite probable that the present tests for color vision, even those which really determine parachromopsia, are unsuitable for selection of personnel for the services, and that color vision should be tested under conditions similar to those in which it is to be used.

KNIGHT DUNLAP

UNIVERSITY OF CALIFORNIA
AT LOS ANGELES

THE SCIENCE MOBILIZATION BILL

AGREEING with Dr. Harlan T. Stetson (SCIENCE, October 22, 1943) that few leading men in science would not accept the five major objectives of the Science Mobilization Bill as he has presented them, I should like to express dissent from the views of the large majority which opposes the bill. I trust that I can do this without the violence and without the words unscientifically chosen, which Dr. Stetson deplores.

I am sure that Senator Kilgore does not claim perfection for his bill and that he would be quite willing to accept modifications which might be brought forth by a calm discussion.

The proponents of the bill must heartily agree with Dr. Stetson's view that the problem is not specifically scientific and technological, but social. It follows that the problem should be solved not solely by scientists and technologists, but by society—in this case by free discussion and action appropriate to our democratic procedures. Scientists must view the proposed measure as members of a social organization which is constitutionally dedicated to the promotion of the general welfare.

Apparently Dr. Stetson believes that no problem exists or that whatever problem may exist is properly taken care of by existing agencies. This is a debatable point. Investigations by Congressional committees, including the current hearings on the Science Mobilization Bill, have brought to light charges that some industrial interests have not always devoted their scientific discoveries to the general welfare. Indeed, it would seem that international cartels of various oil, chemical and drug combines have operated against the interests of the public even in time of threatened war, perilously delaying the full utilization of scientific resources in the production of military and civilian supplies. Since the press, with the exception of a few liberal journals of small circulation, has not carried news of these exposures, it is not strange that a majority of the public, including the scientists, should be unaware of the serious charges that have been made.

Two questions are pertinent to the operation of science in the United States. (1) Does our present organization of science promote the fullest advancement of scientific knowledge? (2) Does our present organization of science promote the fullest development and utilization of science for the public welfare? The two questions are interrelated. That the last two decades have brought about great advances in science in the United States can not be denied, and it would be difficult to prove to the satisfaction of all that the advances might have been greater under another type of organization. But the advancement of science does not in itself lead to the millennium. On the other hand, the social use to which science is put is a determining factor in the development of science as well as in the making of a better world. The two questions, in so far as the public interest is concerned, resolve themselves into one: Do the conditions under which science now operates permit the fullest application of scientific development to the welfare of the nation and its citizens (and since conditions may have been temporarily changed by war, one might add) in peace as well as in war?

If selfish interests are fostered at the expense of the public welfare, the question can not have an affirmative answer, and if such selfish interests are those of a minority they have no place in a democracy once they are recognized as selfish.

No doubt the problem of selfish interest is a perplexing one, and like all perplexing problems should be approached scientifically. But the possibility of "approaching it with the same order of scientific intelligence as one approaches the problems of instability in gravimetry or geomagnetism," as Dr. Stetson suggests, seems at present rather remote. It is particularly so if selfish interest is "a specific entity in human behavior inherited through evolutionary processes as a means for the preservation of the individual and the species." Must we await the same slow evolutionary processes which millions of years ago eliminated selfish interest in societies of insects and which has brought about little if any change since? Fortunately there are psychological and social means, the effectiveness of which is more immediate if less permanent than strictly biological processes. To different degrees and at different times human society has imposed restrictions on the free play of selfish interests by legal and judicial processes or by other cultural means. Selfishness is not legislated out of existence, but it may be checked with fair success. It is a social solution of a social problem, and is as scientific as the use of water to extinguish fire.

Restrictions which may be imposed by majorities on the selfish interests of smaller groups are the safeguards of a democracy. The lack of such safeguards contributed to the seizure of power in Germany by selfish interests which raised their puppet Hitler to the dictatorship. It can't happen here if an informed public opinion is alert to any threat to the general welfare.

The conclusions to which I come are nearly the same as those of Dr. Stetson—that the question resolves itself into the relative merits of no control as against centralized control, of haphazard arrangements as against organization. In this paraphrase I have avoided the words "dangers" and "compulsion" which he uses. There need be no danger so long as we have our democratic rights and privileges to prevent the usurpation of power by selfish interests; there need be no compulsion exerted on any who do not require it in the interest of public welfare.

The National Research Council has done a good job within the limitations imposed on it. It has stimulated, surveyed, promoted, served, directed attention, gathered and collated, and the men who have carried on this work are to be commended for their accomplishments. The fears of some scientists which were expressed contemporary to the creation of the council have not been justified. But it is doubtful if the council has had the power, even though willing to use it, to accomplish all the major objectives of the Science Mobilization Bill.

LELAND H. TAYLOR
WEST VIRGINIA UNIVERSITY

DATES OF PUBLICATION OF SCIENTIFIC PAPERS

IN taxonomy, the solution of a problem often depends upon the determination of the exact dates of publication of the various papers concerned (the application of the law of priority), although in other fields the point is only of historical interest or involves only a desire to give credit where due.

It seems important to emphasize that editors should take pains to make known the actual date of appearance of the journals in their care, especially in these times when printing delays mean that the month or sometimes even the year of actual appearance does not coincide with the stated imprint date.

In one instance which I have met with, the cover and title page both state that the volume appeared on July 15, 1936, whereas I was informed by letter of November 25, 1937, that it was still being proofread. My copy actually arrived on February 18, 1938! A survey of the current periodicals in our library in my own field showed that most of the numbers are now being received from one to three months later than the date stated on the title page.

Some journals, fortunately, have made it a regular practice to insert somewhere in each issue, usually at the end, a statement of the "actual date of publication," date of mailing, date of mailing to a selected list of depositories to establish publication, date offered for sale, etc. Whatever the method, it does seem desirable for editors to consider for their journals some policy relative to making known the actual date of publication, especially for periodicals in fields where questions of priority may be involved.

CURTIS W. SABROSKY
MICHIGAN STATE COLLEGE

MORE ON "STARRING"

IT is hard to believe that Dr. C. A. Browne really believes that the situation is as bad as he indicates on page 281 of the September 24 issue of SCIENCE. I am primarily writing to answer his first question because of my position as a member of the visiting committee for the Chemistry Department of the Massachusetts Institute of Technology but with no other connection with that institution. The question is as to why the list of 82 suggestions for "starring" in the seventh edition of the Biographical Directory of "American Men of Science" includes so many from that institution. The reason is historical. In the past twenty years the institute has lost an unusually large number of outstanding chemists. In spite of vigorous efforts it was impossible to replace these men by other men of approximately similar distinction. Consequently, two presidents of the institute have made every effort to encourage the younger members of the chemistry staff and to add to that staff young men of promise. The result of this policy has been increasingly evident in recent years. Similar factors have been at work at several of the other institutions which show large numbers of "nominations." On the other hand, many of the institutions which have no representatives or only one already have large numbers of their members "starred." Consequently, the possibility of finding a suitable member without a "star" is smaller in those institutions.

Dr. Browne is right in only one point, namely, that there is a chance of the accidental omission of the name of a deserving young scientist by the group which makes the preliminary nominations from which the "voting list" is drawn up. I have thought about this for many years and am now emboldened to make a suggestion which has been running through my mind for some time—that is, that the editors of the directory before asking for nominations from those already having "stars" in a given field write to the heads of important institutions, whether they are starred or not, asking for suggestions. To this plan could be added Dr. Browne's plan of including a certain number of scientists on the basis of what might be called their "bulk productivity" over a definite period of years. This preliminary list could be assembled and sent to the "starred" scientist with a request that he check not over twenty-five of the names and add enough nominations of his own to make a total of twenty-five indicated as his preference. Then the selection could go ahead as in the past. Another suggestion is that an additional balloting be taken so that the cutting down of the number of nominees should be made more gradually and consequently more selectively. I would insist that the final choice should be continued as at present, namely, by those already "starred." It is not possible to obtain any impersonal method which is a substitute for judgment.

F. C. WHITMORE

PENNSYLVANIA STATE COLLEGE

I HAVE followed with some interest the comments concerning the methods of "starring" in "American Men of Science" which have appeared recently in SCIENCE. The remarks by C. A. Browne in the September 24th issue are well taken, but it seems to me that he too has missed the crux of the problem.

I presume most scientific men use the directory for the same reasons that I, as a publisher, do—as a work of reference and information and not as a book which grades scholarship. In this connection, the remarks of the editor in the preface to the first edition concerning the process of "starring" are singularly pertinent.

It would seem that the "starring" was meant to be the basis of an original study and inquiry for the purpose of securing data for a statistical study of the conditions, performance, traits, etc., of a large group of men of science, and these results were to be included in the first edition of "American Men of Science." It is probably fortunate that they were not included. Even more, it was probably impossible to combine the two aims, which are diverse and should remain so. A volume such as "American Men of Science" should be more factual and informative than critical, more descriptive than analytical. A certain discrimination in the selection of individuals must, of course, be exercised and the editors must reserve the right to select the form of the biographical notices and what facts should be included in each biography, such as the vital statistics, education, memberships, institutional connections, and a general statement, in very brief form, of research.

"American Men of Science" should be a directory and record.

RICHARD W. FOSTER

LEA AND FEBIGER,
PHILADELPHIA

SCIENTIFIC BOOKS

ORNAMENTAL PLANTS

Diseases and Pests of Ornamental Plants. BERNARD O. DODGE and HAROLD W. RICKETT. 638 pp. Illus. The Jaques Cattell Press. 1943. $6.50.

IN the course of the past six or seven decades an extensive literature has accumulated concerning the diseases and pests of cultivated plants and forest trees. Many books in the English language, both popular and technical, relating to the enemies of certain plant groups, *e.g.,* cereals, vegetables, fruits and shade trees, are available, not to mention the hundreds of bulletins and circulars issued by various governmental agencies. Yet, despite the universal culture of flowers and other ornamental plants by homemakers and the tremendous investment involved in commercial floriculture, only a few bulletins relating specifically to the troubles of ornamental plants, and no comprehensive books in English, have been available. Ornamental horticulturists and scientists, who have long felt the need for such a book, will therefore welcome the work of Dodge and Rickett, which, in a single volume, discusses the pests, diseases and physiological troubles affecting most of the cultivated ornamental plants.

The book is divided into two parts, part one including an elementary discussion of the symptoms associated with disease and insect injury, a description of the various disease organisms and pests producing such injury and an outline of the methods and materials used in control. Intended for the grower with little or no training in biology, this section is well illustrated by numerous line drawings and photographs which will help to carry the novice through an otherwise forbidding array of fungi, insects and unfamiliar technical terms. The chapter on control methods presents fundamental information which will be helpful to the amateur gardener. The importance of correct cultural methods and garden sanitation is given due emphasis, and many of the standard sprays, dusts and fumigants are discussed. A useful appendix summarizing the common units of measure follows the chapter on control. (Note, however, that the *common* teaspoon, which would be used by most gardeners, holds ⅙, not ⅛, fluid ounce.)

Part two of the book lists and discusses briefly most of the known diseases and pests of over 500 genera of ornamentals, including not only herbaceous and shrubby plants, but shade trees as well. This extensive coverage will be appreciated by grower and scientist alike since it brings together, however briefly, information scattered in hundreds of garden magazines, trade journals and scientific papers, many of which are either unavailable or are obtained only with difficulty. This section reflects the author's experience with an unusually wide variety of ornamental plants and many of the diseases and pests which affect them.

The amateur gardener will find in the book a store of information concerning the many pests which vie with him for mastery of his coveted ornamentals. He will find many suggestions which will help him to obtain the upper hand over these enemies. To the professional floriculturist and ornamental horticulturist the volume will prove useful in identifying many of the diseases and pests which reduce the profit of his operations. However, although directed primarily to the amateur and commercial grower, the book will probably find its greatest market among professional entomologists and plant pathologists who will find it a helpful reference work.

Any book of such ambitious scope, designed to meet the needs of both amateur gardener and professional grower and to be of use to the plant pathologist and entomologist as well, is bound to meet some criticism from all groups. The amateur may hesitate to invest a considerable sum in a book discussing the troubles of 500 plants when his interests might best be served by a more exhaustive treatment of the relatively few ornamentals which he cultivates and in which he is interested.

The commercial grower will in many cases find control recommendations too sketchy, and will be disappointed by the lack of information relative to many up-to-date procedures and modern materials. In discussing fumigants, for example, the authors fail to mention the use of methyl bromide, which has already come into popularity and will probably see very extensive use after the war. Likewise, naphthalene fumigation and its offshoot, Liquid Fulex fumigation, which is very widely and effectively used for the control of red spider mites on greenhouse carnations, are not discussed. Yet Campbell's Patent Sulfurizer for volatilizing sulfur, made in England, not readily available in this country and of questionable value, is described and illustrated. The carnation grower will also fail to find any mention of the dinitrophenol materials which have proved exceptionally effective for the control of red spider mites during the past three or four years. In the general discussion of mites, however, we find a paragraph discussing the reported effectiveness of phthalic glyceryl alkyl (alkyd; SCIENCE, 94: 212, 1941) resin for red spider mite control, though the use of that material appears, even to its manufacturers, altogether impractical. The commercial greenhouse rose grower will be surprised to find that, in the discussion of rose troubles, his greatest enemy, the red spider mite, is given only eight lines and that the rotenone materials are not even suggested for control.

Plant pathologists and entomologists will doubtless agree that, to them, the usefulness of the book would be greatly enhanced by the inclusion of key references to the literature pertaining to the various diseases and pests discussed and by more consistent reference to their geographical distribution. The omission of certain diseases and pests of considerable importance will be noted. While the authors discuss and illustrate the stem nematode disease of phlox, which occurs rarely in this country, the ubiquitous red spider mite and the common Verticillium wilt receive no mention as parasites affecting phlox. Nor do we find reference to mites or powdery mildew on saintpaulia, nor the stunt disease of cyclamen. The professional plant pathologist and entomologist will be puzzled and disturbed by certain control recommendations. In discussing the control of Verticillium wilt of chrysanthemums, for example, the authors suggest that "If cuttings from infested plants are desired, the plants may be treated for half an hour with water heated to 120° F., . . ." This treatment, if indeed it is effective in the control of Verticillium wilt, has not previously been reported so far as the reviewer is aware. At the same time, the authors, while very briefly alluding to hot-water treatment for the control of leaf nematodes on chrysanthemums in their general discussion of control practices, fail to mention this experimentally tested and published method in their specific discussion of the control of chrysanthemum leaf nematodes.

To the specialist in the field covered by the book, the inaccuracies and omissions may assume an exaggerated importance, yet he will appreciate the difficulties involved in preparing a complete and up-to-date presentation in a field so wanting in critical literature. Despite its shortcomings, the book in its present form is a work for which its authors may be commended.

A. W. DIMOCK

CORNELL UNIVERSITY

RAYS

These Mysterious Rays. By ALAN L. HART, M.D. New York: Harper and Brothers. 1943.

THIS fascinating book describes some of the uses of x-ray, radium and ultra-violet radiation for diagnostic and therapeutic procedures in medicine. It is based upon the author's wide experience in the practice of radiology and his equally wide knowledge of the work of the leaders in this field of medicine.

This book is written for the layman. It describes, by simple theoretical discussions and very often by interesting examples, the apparatus and the technical procedures which the radiologist employs. The clarity of presentation is enhanced by reproductions of photographs of x-ray apparatus and of roentgenograms of several parts of the body.

It appears to the reviewer, an electrical engineer who has had the privilege of working with radiologists, that Dr. Hart has effectively and cogently described radiology for the layman, and that the layman is likely to be a more cooperative and understanding patient if he reads this book.

S. REID WARREN, JR.

MOORE SCHOOL OF ELECTRICAL ENGINEERING,
UNIVERSITY OF PENNSYLVANIA

REPORTS

A PROGRESS REPORT ON THE CONSTRUCTION OF POPULATION AND PHYSIOGRAPHIC MAPS FOR THE STATE OF MISSOURI[1]

A FEW years ago plans were laid to construct twin wall maps for the State of Missouri; namely, one showing the physiography, the other showing the distribution of population (1940) within the state. The project is one of compiling and of mapping data and analyzing the distribution of population in Missouri in terms of the physiography of the state. This report indicates the work already done, and the steps to be taken in the future in order to complete the project.

POPULATION MAPS

A map, scale of 1:500,000, published by the U. S. Geological Survey, has been used for the work-sheet maps. This map with rather complete drainage, rail and town patterns provides a convenient size suitable for reproduction as a wall map or even for reduction to desk-size maps.

A map of Missouri has been completed showing the variations in sizes of incorporated places according to 1940 Census data. Circles for cities were left open so that dots representing rural population near cities will show through where necessary. Nine categories of incorporated places from "Under 500" to "cities over 100,000" were set up for the classification of incorporated places. A fairly uniform distribution exists throughout the state except in the south central portion where a wider spacing exists and in the St. Louis area where the suburbs form quite a cluster.

Mimeographed forms were set up on which were tabulated total population by minor civil divisions; incorporated populations by minor civil divisions; unincorporated population for each minor civil division; and the area and density per square mile for the unincorporated population for each minor civil division. All population and area data by minor civil divisions were obtained from the Bureau of the Census. Student assistance was possible through NYA and an university research grant.

The terms "incorporated" and "unincorporated" have been used in place of "urban" and "rural" in order to recognize as many settlements as possible in addition to those listed under the census classification of "urban." In addition the plans call for an isopleth inset map of the unincorporated population. This density map will be developed on a basis showing the urban areas by size categories and the density of rural population per square mile by density categories.

PHYSIOGRAPHY MAP

The physiographic map of Missouri on the scale of 1:500,000 has been partially completed. Contours from the many topographic sheets of the state were pantographed on an interval of 100 feet. The coloring of the map, however, has been on the basis of a

---

[1] No illustrations accompany this considerably condensed article because the maps and tables are not ready for publication or release to the public.

200-foot interval, making it possible to choose the most significant 100-foot contour in any specific area. Approximately a third of the work of this map has been done.

For part of the Ozark area and part of the North Central portion of the state no sheets are available and airplane photographs are to be used to aid in plotting the physiography. Field work may be necessary in order to check some parts of the map. At present the project has been interrupted, but there is no doubt that an accurate physiography wall map of Missouri will be needed as much after the war as now.

SUMMARY

In addition to the two wall maps and the accompanying isopleth map of population distribution the project calls for a detailed analysis of the distribution of the population of the state in terms of the physiography. The two maps on the same scale may be published as twin wall maps in order to portray the geographic distribution of population. In a state with such variety in land forms it is hoped that a close relationship between population distribution and physiography can be brought out with great emphasis. It is hoped that this brief report will record the good intentions of the author to provide new maps useful in the field of geographic teaching and research.

CLARENCE BURT ODELL[2]
THE UNIVERSITY OF MISSOURI

SPECIAL ARTICLES

A FURTHER INTERFERENCE IN EXPERIMENTAL POLIOMYELITIS

WE have long sought a method of demonstrating and studying the "sparing effect" or "interference phenomenon" in poliomyelitis[1, 2] in cheaper animals than the monkey. Mouse experiments have failed to provide a substitute, but an equivalent has been demonstrated in hamsters using strains of virus recovered from the Battle Hill cases.[3]

Young hamsters (40–45 gms) are almost invariably paralyzed within 5 days following the intraperitoneal injection of 0.2 cc of a 10 per cent. suspension of mouse brain collected from animals infected with M-hamster virus. This strain of rodent-paralyzing virus was recovered from a fatal human case by hamster passage.[3] Susceptible animals develop flaccid paralyses of 1 or more extremities between the second and fifth days. Older hamsters are often refractory and can not be used.

If the animals have been injected intracerebrally with certain other rodent paralyzing viruses, they remain free of symptoms. The first experiments were made with McG virus, a weak strain of rodent paralyzing virus isolated in this laboratory. The intracerebral injection of 0.05 cc of a 10 per cent. suspension of mouse brain harvested from animals infected with McG virus rarely paralyzes hamsters but fully protects them against subsequent inoculation with the M-hamster strain. The protection is well developed within 6 days and persists for from 6 to 8 weeks. Armstrong's Lansing strain of mouse poliomyelitis[4] and Jungeblut and Sander's murine SK strain[5] are equally effective. Lymphocytic choriomeningitis also confers protection, as we originally demonstrated in monkeys.[1] Since the other effective viruses may all be related, the action of choriomeningitis and the time relationships are important in showing that the phenomenon is an interference rather than cross immunity.

Suspensions prepared from the brains of young, normal mice afford no protection, but the brains of older mice occasionally have done so. This is believed to imply that latent mouse encephalomyelitis virus is not infrequently present in the brains of old mice.

A suspension of pooled monkey cords, collected 4

EFFECT OF VARIOUS INTRACEREBRAL INJECTIONS ON THE RESISTANCE OF HAMSTERS TO M-HAMSTER VIRUS

Preliminary inoculum	Response	Interval (days)	Number of animals	Response to M-hamster virus	
				None	Paralysis
McG strain	none	1	2		2
" "	"	4	2		2
" "	"	7	2	2	
None			2		2
McG strain	none	6	2	2	
" "	"	26	4	4	
" "	"	34	2	2	
" "	"	47	3	2	1
None			6		6
Lansing (Armstrong)	1 paralyzed	26	4	4	
SK (murine)	All paralyzed	33	3	3	
MV monkey cord	none	21	3	2	1
None			3		3
Feces "Di"	none	7	3	3	
" (heated)	"	7	3		3
Feces "McG"	"	7	3	2	1
" (heated)	"	7	3		3
Feces "Pa"	"	7	3	1	2
" (heated)	"	7	3		3
Feces of newborn	"	7	3		3
None			6	1	5

---

[1] G. Dalldorf, M. Douglass and H. E. Robinson, SCIENCE, 85: 184, 1937. G. Dalldorf, *Jour. Exp. Med.*, 70: 19, 1939.

[2] C. W. Jungeblut and M. Sanders, *Jour. Exp. Med.*, 76: 127, 1942.

[3] C. W. Jungeblut and G. Dalldorf, *Am. Jour. Pub. Health*, 33: 169, 1943.

[4] C. Armstrong, *Pub. Health Rep.*, 54: 1719, 1939.

[2] Now serving in the Office of the Geographer, Department of State, Washington, D. C.

[5] C. W. Jungeblut and M. Sanders, *Jour. Exp. Med.*, 72: 407, 1940.

years ago from animals dying of MV poliomyelitis, also protected hamsters. This led to the testing of Seitz and Berkfeld "N" filtrates of 10 per cent. suspensions of feces collected from human cases of poliomyelitis. Duplicate portions of the filtrates were heated for 1 hour at 60° C. and the feces of newborn infants and presumably uninfected children were also tested. The results of representative experiments have been summarized in the accompanying table.

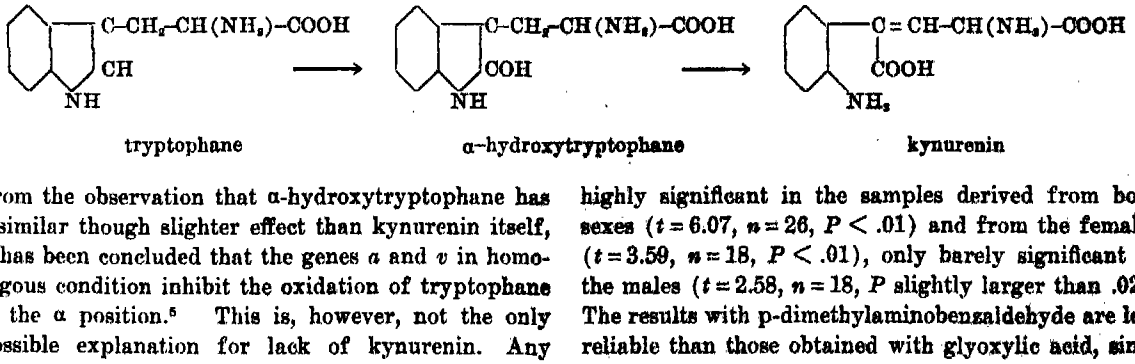
The procedure seems to afford a satisfactory means of investigating the interference phenomenon in poliomyelitis. The results are sufficiently definite to permit the use of small groups of inexpensive animals and the test period is relatively brief. Whether the procedure is useful in demonstrating the presence of poliomyelitis virus, as in feces where other interfering viruses probably do not occur, requires investigation.

GILBERT DALLDORF
ELINOR WHITNEY

GRASSLANDS HOSPITAL,
VALHALLA, N. Y.

THE TRYPTOPHANE CONTENT OF a^+a^+ and aa EPHESTIA KÜHNIELLA Z.[1]

IT has been shown that in Ephestia homozygous for the gene *a* and in Drosophila homozygous for the gene *v* the lack of pigmentation of the eyes and other organs is due to lack of a specific diffusible substance necessary for the formation of these pigments.[2, 3] This substance has turned out to be kynurenin, a derivative of tryptophane.[4] The oxidation of tryptophane to kynurenin proceeds according to Kotake in the accompanying formula.



tryptophane α–hydroxytryptophane kynurenin

From the observation that α-hydroxytryptophane has a similar though slighter effect than kynurenin itself, it has been concluded that the genes *a* and *v* in homozygous condition inhibit the oxidation of tryptophane in the α position.[5] This is, however, not the only possible explanation for lack of kynurenin. Any mechanism breaking down tryptophane in a different way or removing kynurenin in a way so that it can not be used for the formation of pigment would have the same effects. In order to obtain evidence bearing on this question, tryptophane determinations in Ephestia homozygous for *a* and for the corresponding wild type allele a^+ have been undertaken.

Ephestia imagoes were crushed in a mortar and dried in a desiccator over concentrated H_2SO_4. After three days, the dry material was pulverized in a mortar and kept in a dessiccator in the dark until used. In some samples, males and females were kept separately, whereas in other samples specimens of both sexes were used together. Samples of these powders were extracted over night (14 to 16 hours) in 10 per cent. NaOH in a water bath at 56 ± 2° C. The fluid was decanted, the solid washed once with 10 per cent. NaOH, and the washing fluid added to the first solution. The amount of tryptophane in the solution was determined with glyoxylic acid.[6] The developing color was read with an electric colorimeter. In a few instances, tryptophane was determined with p-dimethylaminobenzaldehyde after acid hydrolysis at 37° C.[7] In these cases, the color was determined with a Dubosq colorimeter. The results obtained are indicated in Table I.

In the a^+ a^+ animals, the males contain significantly more tryptophane than the females ($t = 4.08$, $n = 20$, $P < .01$). This is different from the findings of Demyanovskii[8] in *Bombyx mori,* where the females had consistently higher amounts of tryptophane than the males. The difference in tryptophane content between the two sexes in the *aa* race is in the same direction, but insignificant ($t = 0.58$, $n = 14$, P between .5 and .6). In all cases, the *aa* animals contain more tryptophane than the a^+ a^+ animals. This difference is highly significant in the samples derived from both sexes ($t = 6.07$, $n = 26$, $P < .01$) and from the females ($t = 3.59$, $n = 18$, $P < .01$), only barely significant in the males ($t = 2.58$, $n = 18$, P slightly larger than .02). The results with p-dimethylaminobenzaldehyde are less reliable than those obtained with glyoxylic acid, since the visual color determination was interfered with by the appearance of a yellow color in the a^+ a^+ material, which might perhaps be due to kynurenin.[9] It agrees,

---

[1] This work was aided by a grant-in-aid of the American Association for the Advancement of Science. The author wishes to acknowledge valuable advice given by Dr. J. H. Wilson and Dr. F. O. Zillesen of Easton.

[2] E. Caspari, *Arch. Entw. mech.*, 130: 253, 1933.

[3] G. W. Beadle and B. Ephrussi, *Genetics*, 21: 225, 1936.

[4] Rev. by B. Ephrussi, *Quart. Rev. Biol.*, 17: 327, 1942.

[5] A. Butenandt, W. Weidel and E. Becker, *Die Naturw.* 28: 447, 1941.

[6] R. J. Block and D. Bolling, "The Determination of Amino Acids." Burgess Publishing Company, Minneapolis, Minn.

[7] C. E. May and E. R. Rose, *Jour. Biol. Chem.*, 54: 213, 1922.

[8] S. Ya. Demyanovskii, Uchenye Zapiski Fakulteta Estestvoznaniya Moscov. Gosudarst. Pedagogicheskii Inst., Lab. Org. i Biol. Khim. 1938, No. 3, 89.

[9] H. Kikkawa, *Genetics*, 26, 587, 1941.

TABLE I

Genetic constitution	Sex	Per cent. tryptophane	Number of determinations	Method
a^+a^+	♂ and ♀	.233 ± .0138	15	glyoxylic acid
a^+a^+	♂	.297 ± .0074	10	glyoxylic acid
a^+a^+	♀	.206 ± .0192	12	glyoxylic acid
a^+a^+	♂ and ♀	.27	2	p-dimethylaminobenzaldehyde
aa	♂ and ♀	.409 ± .0253	13	glyoxylic acid
aa	♂	.360 ± .0240	8	glyoxylic acid
aa	♀	.335 ± .0326	8	glyoxylic acid
aa	♂ and ♀	.35	2	p-dimethylaminobenzaldehyde

however, with the determinations with glyoxylic acid in so far as in both parallel determinations more blue color was formed in the *aa* than in the a^+ a^+ samples.

It can be concluded from these determinations, that *aa* Ephestia contain more of a substance which gives the reactions characteristic of tryptophane with both glyoxylic acid and p-dimethylaminobenzaldehyde, than a^+ a^+ Ephestia. Since both reactions are supposed to be characteristic of the indole group, the results tend to support the assumption that in *aa* Ephestia the oxidation of the indole ring is inhibited.

Ernst Caspari

Department of Biology,
Lafayette College

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SIMPLE ANALYTICAL METHOD FOR THE DETERMINATION OF PROPYLENE AND TRIETHYLENE GLYCOL[1]

In the course of an investigation of the bactericidal effects of propylene and triethylene glycol it became necessary to devise a rapid and accurate method for the analysis of aqueous solutions containing 50 to 100 per cent. of these substances. Since these solutions were frequently contaminated with small amounts of discoloring impurities or other organic substances, analytical methods such as the determination of the refractive index were of no value. Chemical procedures[2] adapted to the determination of small quantities (0–5 mgm) are too cumbersome and involve tedious and inaccurate dilution methods in addition to the possibility of not obtaining a representative sample.

We found that the viscosity of an aqueous solution bears a very regular and definite relationship to the quantity of glycol present in the solution. From this observation the apparatus shown in Fig. 1 was constructed. It consists of a 12-inch length of 7 mm glass tubing, the end of which had been held in a flame until the opening was closed to about 0.2 mm. Interval marks were placed 6 inches apart and 3 inches from both ends. The tube, including the marked-off interval, was surrounded by a water jacket consisting of an 8-inch length of 20 mm tubing; this was fixed by means of a cork.

To make a determination the water jacket is filled with water at 25° C. and the unknown solution, the temperature of which has previously been adjusted to 25° C., is drawn into the inner tube by means of suction on a small length of rubber tubing attached to the top. The rubber tube is then constricted, holding the column of liquid in place. When the constriction is released the meniscus of the liquid slowly falls. The time required for the meniscus to pass the interval marks is determined by a stop-watch.

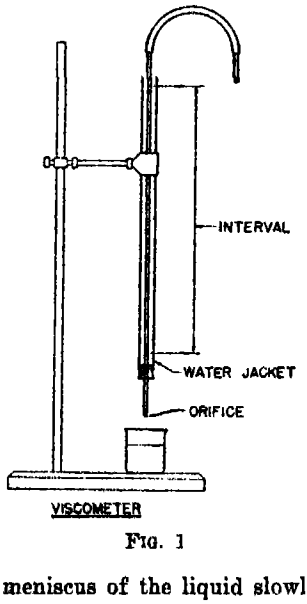


Fig. 1

Known solutions were carefully prepared, using volumetric methods. The concentrations of these solutions ranged from 50 to 100 per cent. glycol in water. The time required for each solution to pass through the orifice was recorded by a stop-watch and the values charted in Fig. 2. Repeated determinations showed this method to be accurate to ± 0.001 minutes.

---

[1] From the Northwestern Technological Institute and the Department of Medicine, Northwestern University Medical School. The work described in this paper was done under contract, recommended by the Committee on Medical Research between the Office of Scientific Research and Development and Northwestern University.

[2] T. T. Puck, Science, 95: 178, 1942.

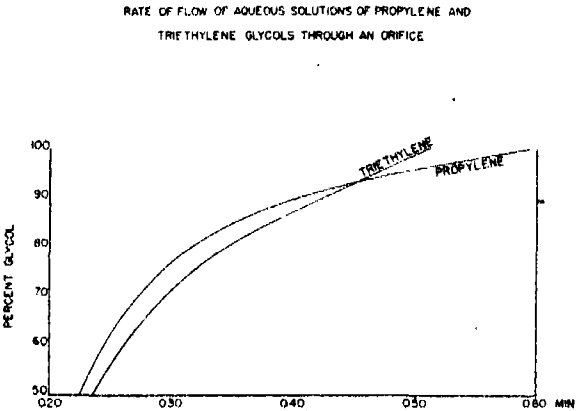


Fig. 2

Since the orifice of any given apparatus is arbitrary it would be very difficult to reproduce exactly our data. Therefore, a graph—Fig. 3—was constructed to enable the rapid calibration of any orifice. This was determined by plotting the relative viscosities of glycol to water against the known concentration of glycol. These relative viscosities were obtained by measuring the time for pure water at 25° C. to pass through our orifice and our interval. When the time required for a known series of glycol solutions to pass through any viscometer is divided by the time for water to pass through the same system the curve is obtained. Since the densities of the two liquids are practically equal they may be ignored in computing the relative viscosity. Therefore, when a new apparatus is constructed, generally having a somewhat different-sized orifice, it is only necessary to obtain the time interval using pure water. When this value for water is multiplied by the various viscosities of the glycol solution, taken from Fig. 3, a curve is easily constructed to fit the particular apparatus.

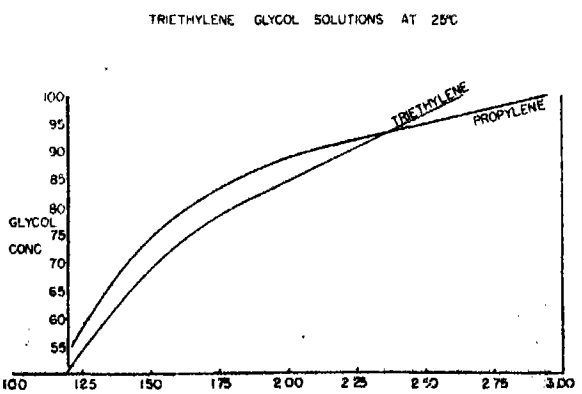


Fig. 3

Conclusions

This apparatus is easily constructed and can determine the concentration of glycol solution with an error of less than 0.5 per cent. The time required for a determination is about one minute, depending upon the size of the orifice. Using this method and the data supplied it is not necessary to measure the absolute viscosity but only the time utilized by the glycol solution in passing a given interval through an arbitrary orifice.

Sherman Fried
Edward Bigg
Burgess H. Jennings

A SIMPLE METHOD FOR PREPARING AQUEOUS SUSPENSIONS OF URINARY SEX HORMONE RESIDUES[1]

The two commonly used vehicles for subcutaneous injection of urinary female sex hormone residues are oils (sesame or corn) and water. Neither is wholly satisfactory. The oils are poorly absorbed by the experimental animal and tend to encapsulate. Water is a poor solvent for the sex hormones and the inactive contaminants present in urinary residues. An aqueous suspension has been successfully employed,[2] but its preparation is rather laborious.

We wish to report a simple method for preparing an aqueous suspension of the urinary female sex hormone residue, which we have found to be entirely satisfactory.

The residue is dissolved in 2 ml of ethyl alcohol. From 0.1 to 0.2 gm (small spatulaful) of sodium alginate[3] and exactly 30 ml of water are added and the mixture is stirred on a hot plate, just short of boiling, for two or three minutes. On cooling, the suspension should have about the same viscosity as that of a heavy oil.

The success of this procedure depends upon two factors: (1) Care must be taken to add the right amount of sodium alginate, as too much will result in gel formation; a little practice soon establishes the ideal proportion to be used. (2) The stirring should begin while the water is being added in order to insure maximum dispersion of the insoluble material.

The resulting suspension is stable and shows no observable tendency to seep out at the site of injection when a No. 20, 1½ inch needle is used. The foreign material is completely absorbed and well tolerated by the spayed rat. No unfavorable reactions have occurred over a six-month period of repeated injections of our rat colony with this agent.

Benjamin F. Stimmel

San Diego, Calif.

---

[1] From the Rees-Stealy Medical Research Fund.

[2] Gustavson, R. G. et al., Am. J. Obst. & Gynec. 35: 115 (1938).

[3] Prepared and sold under the name of Kelgin by the Kelco Company, San Diego, Calif.

SCIENCE

VOL. 98 FRIDAY, DECEMBER 3, 1943 No. 2553

Emotions and Gastric Function: DR. HAROLD G. WOLFF 481

Petroleum, Past, Present and Future: DR. PER K. FROLICH 484

Obituary:
John Muirhead Macfarlane: DR. WALTER STECKBECK. *Recent Deaths* 487

Scientific Events:
Enlargement of the Laboratory Staff of the U. S. Forest Products Laboratory; The Pacific Map of the National Geographic Society; Destruction of the Berlin Herbarium; Meetings of Entomologists; The Informational Service of the Division of Medical Sciences of the National Research Council; Royal Society Medalists 489

Scientific Notes and News 492

Discussion:
Angiotonin or Hypertensin: DR. B. A. HOUSSAY and OTHERS. *The Triptane Process:* DR. VLADIMIR HAENSEL and PROFESSOR V. N. IPATIEFF. *Concerning Translations of Geological Texts for South American Students:* DR. WARREN D. SMITH 495

Scientific Books:
Chemical Spectroscopy: DR. L. G. S. BROOKER. *Temperature:* DR. ROBERT B. SOSMAN 496

Special Articles:
Desthiobiotin: PROFESSOR VINCENT DU VIGNEAUD and OTHERS. *Rations for the Study of the Relative Nutritive Value of Fats and Oils:* PROFESSOR E. B. HART and OTHERS 497

Scientific Apparatus and Laboratory Methods:
The Fractional Cephalin-Cholesterol Flocculation Test: DR. I. ARTHUR MIRSKY and RUBY VON BRECHT. *A Technique for Differentiating the Cells of the Pituitary of the Rat:* MIRIAM REED 499

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

EMOTIONS AND GASTRIC FUNCTION[1]

By Dr. HAROLD G. WOLFF

CORNELL UNIVERSITY MEDICAL COLLEGE

REVIEWING the life histories of the patients with ulcers, Mittelmann and Wolff found that the patients had been subject to prolonged emotional turmoil, involving mainly conflict, anxiety, guilt, hostility and resentment.

During periods of experimentally induced anxiety, hostility and resentment, they found a rise in acidity and increased contractions in the stomachs of all the patients suffering from ulcer and in many of the normal subjects. Moreover, they were able to reverse this process and cause a decrease in acidity and motility by inducing in their patients feelings of contentment and well-being.

In all the patients with peptic lesions it was possible to demonstrate a chronological parallelism between the onset, recrudescence and course of gastroduodenal symptoms, and the occurrence of untoward emotional reactions. The situations that prompted these reactions were not necessarily dramatic or in the nature of crises, but, because of the existing emotional frame within which they occurred, they had important effects on the patients.

To demonstrate that the above-described emotional states were relevant to the gastroduodenal dysfunction and peptic ulcers in the particular patients studied, situations were experimentally created which induced destructive emotional reactions and precipitated symptoms when the patient was free of symptoms. Moreover, if such effects, symptoms and tissue defects already existed, all increased in intensity during such experimental procedures. On the other hand, in situations which engendered feelings of emotional security and assurance, gastric function was restored toward normal and symptoms eliminated, in those with symptoms and abnormal function.

The facts of this study emphasize the occurrence in the same individual of the aforementioned destructive emotions coupled with increased motility and secretion and mucosal circulatory changes in the stomach and duodenum, followed by evidence of gastritis and duodenitis and ultimately actual ulceration. This sequence suggests that the increased secretion, increased motility and disturbed circulation, mucosal erosions and ulcerations are phases of the same process differing only in the amount of tissue destruction in the stomach and duodenum.

---

[1] Delivered at the New York Academy of Medicine Graduate Fortnight, October 11, 1943.

To further validate these views, an intensive investigation was made by Dr. Stewart Wolf and the speaker[2] of a man who afforded them an exceptional opportunity to visualize the inside of his stomach.

Method

The man, aged 56 at the time of the study, completely occluded his esophagus at the age of 9 by drinking scalding hot clam chowder. Since then, he has fed himself through a gastric fistula 3.5 cm in diameter, surgically produced shortly after the accident. It is his custom to put food into his mouth and, after tasting and chewing it, to expectorate it into an ordinary kitchen funnel inserted into his stoma. Through the stoma has protruded on his abdominal wall a collar of gastric mucosa essentially similar to that within the cavity of the stomach. The patient is in excellent health, has rare digestive complaints and is employed as a "diener" in the laboratory. He is a small, wiry man of Irish-American stock, unschooled, married and the father of one child. He is shy, sensitive, proud, stubborn and slightly suspicious. He is fun-loving but very conscientious.

Estimates of vascular changes were made.

The stomach was emptied every fifteen minutes and the juice obtained was titrated for free hydrochloric acid and total acid.

In many of the experiments, records of the stomach contractions were made.

Careful note was made of the patient's mood and the content of his thoughts and preoccupations. These data were collected during the experiments as well as at separate daily interviews. An attempt was made to classify the emotional and other reaction patterns as contentment, joy, gratitude, feelings of helplessness, dejection, doubt, fear, frustration, guilt, sadness, anxiety, tension, hostility and resentment. None of these existed alone, but usually it was possible to recognize one or two as dominant. The emotional reactions were then correlated with the various measurements of gastric function.

The emotionally charged situations were not experimentally induced. Spontaneously occurring life situations, problems and conflicts were utilized. Some of these involved events arising from time to time in the laboratory. Others occurred in the setting of the subject's home life. His reaction to each of these experiences was evaluated in the light of his individual personality pattern. Thirty-four observations on stomach function accompanying several different affective states were made. From these, illustrative examples will be presented.

Observations

During the periods when the subject was relaxed and apparently contented, the color of the mucosa remained relatively constant. Contractions were usually of low amplitude and rhythmic, making a pattern of three small waves a minute.

Spontaneous Periodic Phases of Accelerated Gastric Function.—Every two to three hours, there occurred in the stomach a transitory phase of hyperemia, hypersecretion of acid and vigorous contractions. These followed a rather constant pattern and lasted only twenty to thirty minutes. After the phase of accelerated gastric function had subsided, the stomach assumed its former "basal" condition.

Depression of Gastric Function in Association with Fear and Sadness. Fear: The patient suddenly experienced intense fear one morning in the midst of a phase of accelerated gastric function. An irate doctor entered the room muttering imprecations about an important protocol which had been lost. The patient had mislaid it and feared he had lost the record and his job. He lay motionless on the table and his face became pale. Prompt and decided pallor occurred also in his gastric mucosa, and associated with it there occurred a fall in the rate of acid production. A minute later, the doctor found his paper and left the room. Forthwith the face and gastric mucosa of the patient regained their former color.

Sadness: Sadness, dejection and feelings of self-reproach were accompanied in this subject by taciturnity, lack of "energy," slowness of movement of the body generally and by pallor of the gastric mucosa, decreased acidity and motor activity. Even the stomach's normal response to the ingestion of food was inhibited under these circumstances.

One morning, the patient was depressed and uncommunicative over having lost, through his own negligence, an option on a house which he had long been eager to acquire. He was limp and dejected and filled with feelings of self-depreciation and refused to relate the nature of his trouble until several hours later. Beef broth was administered directly into his stoma and it was noted that the hyperemia and acceleration of acid production and motility, which regularly followed ingestion of beef broth, were partially inhibited.

Acceleration of Gastric Function in Association with Emotional Conflicts Involving Anxiety, Hostility and Resentment. During a period of "basal function" of the stomach one-half hour after a spontaneous phase of accelerated function, a member of the staff entered the room to pay off and discharge the subject from a job he was doing for the doctor after hours in order to earn some extra money. The doctor had complained earlier that he was slow, ineffective and charged too much. The subject, who takes great pride in his conscientious attitude toward his duties, resented heartily these charges. When the physician told him he need not report for work any more, he accepted the rebuff politely, but quickly his stomach became red and engorged and soon the folds were thick and turgid. Acid production accelerated sharply and vigorous contractions began. This happened in spite of the fact that another spontaneous phase of accelerated gastric function was not to be expected for at least an hour and a half.

---

[2] Human Gastric Function. Stewart Wolf and Harold G. Wolff. Oxford University Press, New York, 1943.

These changes were noted frequently in association with feelings of strong hostility and resentment on the part of the patient, and also with anxiety. It is noteworthy that these incidents occurred far more commonly than did those described earlier, in which there was an associated inhibition of secretion, motor activity and vascularity.

The degree and duration of the changes in gastric function were also roughly proportional to the intensity and duration of the emotional reaction.

An illustration of prolonged acceleration of gastric function is as follows: The patient was usually in a state of comparative financial insecurity, and because of this he was compelled to accept gifts from a certain benefactor. The latter meddled in the subject's personal affairs and when denied a hand in managing them, threatened to withdraw support. During two weeks of such meddling, the patient became intensely anxious about his future welfare and resentful of the activities of his benefactor. He was eager to throw off his dependence. At the end of the two weeks, the opportunity for release came in the form of a raise in pay for his job at the hospital. This good fortune he received with the deepest feelings of relief.

Gastritis, Pain and Mucosal Erosions. In the presence of hypermotility and hypersecretion, the gastric mucous membrane not only became red but engorged and turgid as well.

During periods when his stomach was in this state, occurring as they did in association with emotional conflicts involving anxiety, hostility and resentment, the patient often complained of heartburn and abdominal pain. Indeed, it was possible to demonstrate experimentally that the tissues of the stomach wall were more sensitive to pain in their hyperemic state than normally. Vigorous contractions of a magnitude insufficient to cause pain in its normal state were painful when the stomach was intensely engorged.

Furthermore, the susceptibility of the mucosa to injury resulting in hemorrhage was found to be greatly enhanced in this condition of engorgement and hyperemia. Even relatively trifling traumas such as striking the membrane with a glass rod or stroking it with dry gauze resulted in small erosions and bleeding points. Frequently during periods of such hyperemia, vigorous contractions produced bleeding points around the periphery of the exposed collar of mucosa without the necessity of instrumentation.

Healing in the Stomach: The Protective Properties of Mucus. Ordinarily these small erosions and bleeding points which occurred from time to time were quickly covered with mucus and healed uneventfully in twenty-four hours or less. The failure of any of these lesions to persist as a chronic ulceration will be shown to be due largely to the effective protection afforded by the mucus.

When irritating substances such as mustard, strong acid or alkali were placed on the lining of the stomach without care being taken to remove the mucus coating, only a slight to medium erythema resulted. When the accumulation of protective mucus was continually aspirated away, however, and mustard was applied directly to the cells of the mucosa, acute inflammation and edema resulted. Bleeding points and small erosions appeared throughout the area involved. Pinching and faradic stimuli applied to the mucosa in this condition caused pain, although pain did not occur when these stimuli were applied to the mucosa in its normal state.

The protective powers of mucus have been shown to consist of three distinct mechanisms: First, it presented a continuous slippery surface to irritants. Second, by combining with and neutralizing the acid in immediate contact with it, it maintains the acidity of the stomach lining itself at a relatively low level. When a drop of Toepfer's solution was allowed to fall on the wall of the stomach, it failed to indicate an acid reaction despite the fact that a sample from a nearby pool of accumulated gastric juice contained 65 units of titratable free acid. An important aspect of this protective device is the fact that mechanical and chemical irritation of the gastric mucosa, as well as the presence of acid in high concentration in the stomach, accelerates the rate of production of mucus. Circumstances arose, however, when the amount of acid in the stomach exceeded the powers of this compensatory mechanism. Then the third protective property of mucus was invoked. The mucus precipitates and forms an insoluble, continuous, tough membranous coating over the cells of the gastric mucosa, thus insulating them from chemical attack.

Result of Continued Contact of Gastric Juice with a Mucosal Erosion. To demonstrate the effects of contact of gastric juice with an eroded surface, the following experiment was conducted:

Two small bleeding points were produced in the gastric mucosa by traumatizing it with a smooth-edged forceps. These tiny eroded areas were kept in contact with gastric juice for one-half hour. The protective mucus which accumulated rapidly in this region was sucked away frequently and fresh gastric juice applied. A sharp acceleration of acid secretion and concomitant hyperemia of the whole gastric mucosa resulted from this procedure, and these effects persisted for one-half hour after the exposure of the erosions to the action of gastric juice had been stopped. After the undisturbed lesions had become covered by mucus, the color and acid values returned to normal.

This experiment supports the idea that the acceleration of acid secretion resulting from erosions being bathed in gastric juice is one mechanism involved in the maintenance of hyperacidity in patients suffering from peptic ulcer.

It can thus be shown that when an unprotected mucosal erosion is exposed to the digestive action of gastric juice, additional tissue damage occurs and chronic ulceration results.

COMMENT

The difference between a hypersecreting stomach and actual gastritis is, as has been shown, mainly one of degree. Prolongation of inordinate hypersecretion in the stomach with the inevitable accompanying hyperemia, then, carries with it the hazard of possible structural damage to the lining of the stomach or even more likely to that of the duodenal cap, since the latter is less well protected.

Once an erosion has been effected, contact of acid gastric juice with the denuded surface would perpetuate the vicious cycle as illustrated in the experiment described.

It has been shown that situational factors resulting in emotional conflict with anxiety, hostility and resentment may induce in the stomach profound and prolonged hyperemia, hypermotility and hypersecretion. Adequate neural mechanisms exist to explain these phenomena. The reason that the patient experimented with has not acquired peptic ulcer may be that the hyperemia and hypersecretion which were observed in the presence of conflict have been relatively transitory. He is not the sort of person who harbors grudges or maintains emotional stress for prolonged periods. Usually he expressed his feelings in words or in action, and his more serious conflicts were relatively short lived. Since the occurrence of gastric hyperfunction in certain emotional settings has been demonstrated, however, and since the destructive power of excessive gastric secretion has been established, one may infer that these emotionally charged situations are involved directly in the genesis of peptic ulcer in man. Hyperacidity, gastritis, minor mucosal erosions and finally peptic ulcer occurring during the course of sustained emotional tension should not be looked on as separate clinical entities. The evidence indicates that they are all phases of the same pathologic process.

PETROLEUM, PAST, PRESENT AND FUTURE. II

By Dr. PER K. FROLICH

ESSO LABORATORIES, STANDARD OIL DEVELOPMENT COMPANY, ELIZABETH, N. J.

The domestically available energy source most closely related to crude oil is natural gas. The production and consumption of natural gas by states, although by no means identical to the distribution shown for crude oil in Fig. 9, follows much the same general pattern in that transportation by pipe line makes for a marked flexibility in distribution. To most of us it does not mean much when we are told that the country's proved natural gas reserves amount to some 95 trillion cubic feet.[11,12] A little figuring will show, however, that on a weight basis this is equal to about 75 per cent. of the proved reserves of petroleum. At the present rate of consumption the proved gas supply should last about thirty years, or twice as long as the oil supply. Methods are known for converting these natural gas hydrocarbons into liquid petroleum fractions. The heavier constituents can be processed by such direct methods as cracking or dehydrogenation, followed by polymerization and alkylation. Methane, however, which is the major constituent of natural gas, can best be converted into gasoline by the Fischer-Tropsch process. In that case the methane must first be reacted with steam to give a mixture of carbon monoxide and hydrogen, which is then treated with a catalyst to produce liquid hydrocarbons. Technical information is available on this process, but as yet this country has no large-scale operating experience. The process has been used commercially in Germany for some time, and a small pilot-plant unit for carrying out the Fischer-Tropsch

---

[11] Energy Resources Committee, "Energy Resources and National Policy," Rept. to Nat. Resources Comm., January, 1939.

[12] E. H. Poe, *Oil Gas Jour.*, July 28, 106, 1943.

synthesis is now in operation at the Bureau of Mines.[13] It would be unwise at this time, however, to make any prediction in regard to the amount of gasoline that might be produced in this manner.

A much larger potential supply of liquid hydrocarbons is obtainable from the oil shales of the United States. Most important are the Tertiary oil shales of the Rocky Mountain region, located chiefly in Colorado and Utah. Other deposits are the Devonian black shales of Indiana and Kentucky and the cannel shales of Pennsylvania and West Virginia. In 1928 these shale deposits were estimated by Dean E. Winchester as capable of producing 92 billion barrels of oil.[14] Although this is still considered the most authoritative figure, a great deal of assay work must be done before an accurate estimate of practically available oil from shale can be made. It can definitely be said, however, that the potential supply of liquid hydrocarbons from this source is high compared with known crude oil reserves.

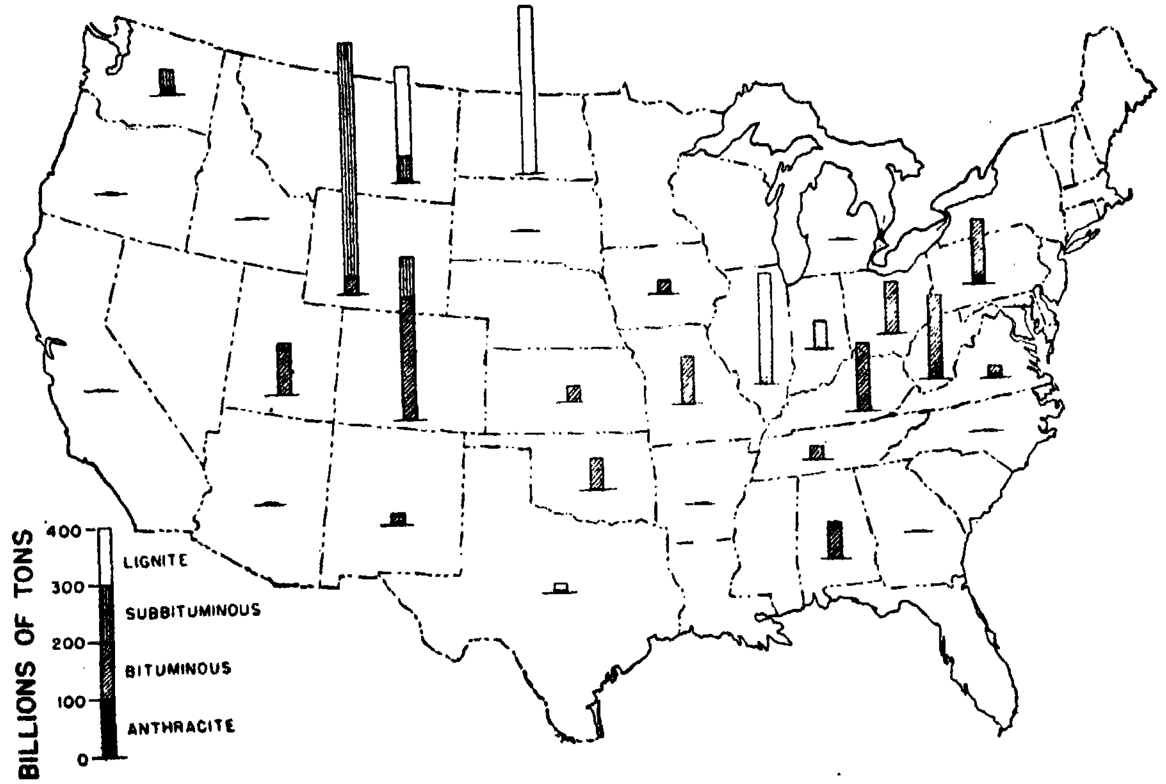


FIG. 12. Coal reserves by states as of January 1, 1937. Anthracite, subbituminous and lignite reduced to bituminous coal equivalent, according to "Energy Resources and National Policy."[11]

Oil is now being recovered from shales on a limited scale in various parts of the world by retorting under suitable conditions of temperature and pressure. From 1925 to 1929 the Bureau of Mines experimented with the recovery of oil from Colorado shales. Although no commercial scale production was undertaken, sufficient work was done to demonstrate the practicability of producing oil from this source. The oil obtained by retorting shale differs from conventional crude oil in that it has a higher percentage of unsaturated hydrocarbons, a lower percentage of gasoline, a higher wax content and relatively high content of phenolic compounds and nitrogen bases. Additional work therefore remains to be done on the development of satisfactory refining methods.[14,15]

Beyond the borders of the United States, the Canadian deposits of tar sands can also be included. These deposits spread over thousands of square miles through the central portion of the Williston Basin in the Province of Alberta. They are composed of sands saturated with oil, and figures indicate the reserves of the Athabaska deposits to range from 100 billion barrels up to many times that quantity. Pratt gives an estimate of 100 to 250 billion barrels,[5] which places Ahabaska tar sand as one of the largest potential sources of petroleum in North America. However, the fact that these sands must be mined to extract their tar oil content presents practical difficulties. Of the total area, variously estimated at 10,000 to 50,000 square miles, not more than 10 square miles, containing perhaps 500 million barrels of oil, can be considered workable by strip mining methods.

---

[13] A. C. Fieldner, statement before Joint Committee on Public Lands and Surveys, U. S. Senate, August 4, 1943.

[14] Federal Oil Conservation Board, Rept. II, p. 13, January, 1928.

[15] B. H. Weil and W. Weinrich, *Oil and Gas Jour.*, April 22, 48, 1943; April 29, 73, 1943.

Aside from the development work which remains to be done on improved methods of recovery and refining, the production of oil from the tar sands as well as from shale presents a problem in waste disposal. Even though this may not be a representative illustration, an oil recovery of 13 per cent. by weight may give approximately 1.5 cubic yards of solid material as waste per barrel of oil produced. This will tend to confine at least the initial processing operations to the point of mining.

The largest potential source of liquid hydrocarbons is, without doubt, our coal reserves. Coal accounts for more than 98 per cent. of the country's known energy resources, not including water power. (All water power, developed and suitable for development in the United States, would supply less than 25 per cent. of our present total energy requirements.) These coal deposits amount to more than 3 trillion tons. As Fig. 12 shows, almost 70 per cent. of the total coal reserves lies in the semiarid plains or in the Rocky Mountains, far from present centers of population and industry. About 85 per cent. of current production is from the 30 per cent. of our reserves east of the Mississippi River. The anthracite deposits are largely confined to Pennsylvania, with lesser quantities located in Virginia and Arkansas, and only smaller amounts in Colorado and Washington.[11]

Liquid fuels may be produced from coal by various methods such as low-temperature carbonization, the Fischer-Tropsch synthesis and high-pressure hydrogenation. The two latter are of most interest from the standpoint of yields obtainable. According to Petroleum Administrator Ickes, it is possible that some 50 million barrels of gasoline may now be made annually in Germany by high-pressure hydrogenation.[16] Coal has also been hydrogenated for some time in England on a less extensive scale. In this country the Bureau of Mines has in operation a laboratory-scale pilot plant for direct hydrogenation of coal,[13] and has been working on plans for the installation and operation of industrial-scale pilot plants. In recent hearings before a joint committee of Congress, Ickes strongly endorsed a proposal for the Government to build and operate larger-scale demonstration plants for the production of oil from coal. In his words, this "is a proposal to blaze the path now for private capital to do this job when we have no more natural domestic petroleum and it becomes a question of synthetic liquid fuel or the end of the gasoline age." There is no need at this time to go into further discussion of the quality of gasoline that may be produced by these various processes or the yields obtainable from different types of coals. According to Ickes' estimate, the available coal reserves can provide the synthetic fuel we need for a thousand years and still leave enough coal for other present-day purposes.[16]

This review has been concerned only with the available raw materials which have been handed down by nature through the ages. By growing vegetable matter it would undoubtedly be possible to extend these supplies, but the potentialities of this source of energy can not readily be estimated. A discussion of some of the technical and economic aspects of this problem is presented by Burke Jacobs in the report on "Energy Resources and National Policy.[11]

As to the question of cost, it may be well to consider the figures in Table 1 which were submitted by Farish before a House Committee last year.[17] These data indicate that gasoline from such alternate raw materials can be produced at a cost sufficiently close to present prices so that with an increasing cost of crude oil we may expect a gradual upward trend rather than any abrupt increase in the cost of gasoline and related products. In this connection, the petroleum

TABLE 1

COMPARISON OF METHODS FOR MOTOR GASOLINE PRODUCTION

Process	Approx. cost per barrel motor gasoline per day[a]	Approx. tons steel per barrel motor gasoline per day	Approx. gasoline cost, cents: Direct cost, including normal overhead but excluding depreciation	Approx. gasoline cost, cents: Total cost, including normal overhead and 10 per cent. depreciation
High-pressure coal hydrogenation	$12,800	14.1	15.9	22.6
Fischer, European design starting from coal ...	7,600	8.9	14.7	19.2
Fischer, European design starting from natural gas[b]	4,750	6.5	6.0	8.8
Modern high-pressure hydrogenation of petroleum[c]	1,150	1.4	4.8	5.5
Modern oil refinery, $1.20/bbl.[d]	700	0.7	5.1	5.3
Modern oil refinery, $2/bbl.[d]	700	0.7	8.3	8.5

[a] 1942 costs for complete plant including all utility supply and auxiliaries.

[b] Natural gas at 5 cents per 1000 cubic feet.

[c] Crude at $1.20 per barrel.

[d] Crude price at the well.

---

[16] H. L. Ickes, statement before Joint Committee on Public Lands and Surveys, August 5, 1943.

[17] W. S. Farish, hearings before Subcommittee of Committee on Mines and Mining, U. S. House of Representatives, July 15, 1942.

industry has not so far benefited by any appreciable increase in price level. Compared to August, 1939, the start of the present war, all commodities have increased 38.3 per cent., farm products 103.1 per cent., foods 61.2 per cent. and petroleum 19 per cent.[8] As Fig. 13 shows, the petroleum industry's record is one of decreasing costs brought about by technological improvements. This is particularly evident from the lower curve which represents the average gasoline cost in recent years, excluding the steadily mounting taxes. With a guaranteed supply of basic raw materials we should, in light of the petroleum industry's past achievements, be able to look with confidence toward the future.

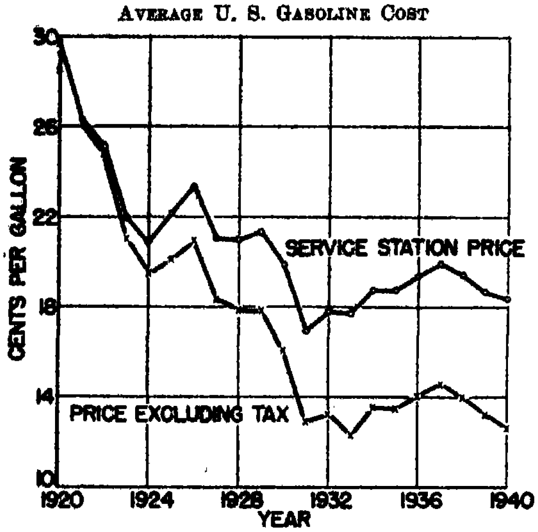


FIG. 13. Cost of gasoline in the United States (average for fifty cities.)

It is not possible to predict the exact sequence of technical developments which lie ahead of us in this field. There is also a great deal of uncertainty in regard to the time element involved. New discoveries of crude reserves or an early termination of the war would undoubtedly relieve the present situation and delay the need for synthetic products; conversely, a prolonged war with continued heavy demands for petroleum would, in the absence of any substantial new discoveries, accelerate the need for alternate sources of supply. When the day comes, however, that the petroleum industry must turn in earnest to new sources of liquid fluids, its dependence on chemistry and engineering will become increasingly great. Whether the problem is one of recovering oil from shale, of liquefying natural gas, of working the tar sands or of hydrogenating or otherwise liquefying coal, chemistry and engineering will be called upon to work out processes which in major respects will differ from those currently in use by industry. We hardly need be concerned over the future of petroleum chemistry in general or even of the present trend toward utilization of petroleum as a chemical raw material, for these new processes will continue to yield the conventional hydrocarbons now obtained from crude oil and natural gas. In addition, such alternate processes are likely to increase the supply of hydrocarbon derivatives containing oxygen, sulfur and nitrogen which are being obtained from petroleum in such *dilute concentrations* that only *in exceptional* cases is their recovery a paying proposition.

This leads to the following general conclusions: In addition to the petroleum known to be present in the ground, large but as yet undiscovered reserves may be expected to exist in different parts of the world, including the United States. How long we can continue to locate this oil and bring it to the surface at the desired rate is an open question. At some future date, whether it be in the immediate future, in the next generation or in a much later generation, a shortage in natural petroleum will occur. In the meantime, there is nothing to indicate that this should result in any sudden change as far as our supply and consumption of gasoline and other petroleum derivatives are concerned. Progress will continue in the petroleum industry's efforts to improve the efficiency of its processes and the quality of its products. Advances in engine construction will make for better efficiency in the utilization of fuels and lubricants. Increased drilling on a world-wide basis will bring in more oil. There will be necessary adjustments in supply and demand so that oil will be moved freely from the principal centers of production to the principal centers of consumption. All this will tend to prolong the necessity, at least in time of peace, for turning to alternate sources of supply. As the need arises, synthetic products from the sources indicated will then gradually work their way into the picture.

OBITUARY

JOHN MUIRHEAD MACFARLANE

September 28, 1855—September 16, 1943

JOHN MUIRHEAD MACFARLANE, professor emeritus of botany at the University of Pennsylvania, died at his summer home, Lancaster, N. H., on September 16, twelve days before attaining his eighty-eighth birthday. He was born at Kircaldy, Scotland, and received the B.S. and D.Sc. degrees from the University of Edinburgh, where he held various academic positions, including that of professor in the Royal Veterinary College. In 1891 he was invited to speak before the American Association for the Advancement of

Science on insectivorous plants, especially on Dionaea. While in this country he was invited to a professorship in biology at the University of Pennsylvania; he accepted and in 1893 became professor of botany, a position held until his retirement in 1920.

Through the untiring and unremittant efforts of Dr. Macfarlane as head of the botany department and director of the botanic garden over a period of twenty-seven years great advances and constructive improvements were wrought, both for the cause of botany at the university and for the general field of this science. From "extended vistas of sand-hills and gravel hollows" there was evolved a well-balanced and highly useful botanic garden. From a shelf with seventeen volumes on botany in 1893 there emerged a well-stocked botanic library with more than five thousand volumes. Greenhouses were erected and filled with a large and representative collection of plants. Laboratories were equipped with essential apparatus. The faculty was enlarged and the student body greatly augmented from time to time, with five hundred students taking courses in botany in 1920. Dr. Macfarlane believed in the influence and usefulness of subsidiary organizations that would serve to bring the alumni of the university and the general public in contact with the botanical department of the university. With this aim in view he founded the Botanical Society of Pennsylvania in 1897. This organization, which very soon included 150 members, has continued to the present and held the founder's interest and guidance to the end of his long life. The Graduate Botanical Club, organized about the same time, served to unite faculty, graduate students and graduates in their common interests. At the bi-weekly meetings results of investigations were reported and botanical literature was discussed. These meetings were preceded by a social hour when a repast was served. Here also Dr. Macfarlane showed that delightful geniality so characteristic of this beloved Scot and frequently he recited bits of Scotch poetry and prose in his pleasing native brogue into which he could lapse so readily.

A classical as well as a scientific background in his training, wide experience in the laboratory and in the field and the close association with his fellow man, all gave Dr. Macfarlane a universality of knowledge and a versatility of application seldom found in any one individual. He will be remembered longest as a magnetic teacher, who loved students and who never "talked down" to them but rather on the same plane. Classes coming to him for the first time were usually greeted by "Fellow Students" which would put even the most timid student at ease. He was never too busy to help and to counsel the student. To his colleagues he was ever an inspiring leader. He was an ideal friend and host and the portals of his office and of his home were ever open to all his friends.

Although Dr. Macfarlane carried a heavy teaching schedule, yet he found time for research, writing and publishing more than 140 volumes, monographs and contributions. He was active in research practically to the end of his long and full life, leaving much unpublished work, mainly on taxonomic botany. The unique versatility and ability in his researches are portrayed in the variety of scientific fields which he explored so thoroughly. He held first rank as an authority on insectivorous plants. To cite some of his volumes—as "The Causes and Courses of Organic Evolution," "The Evolution and Distribution of Fishes," "Fishes the Source of Petroleum," "The Quantity and Sources of our Petroleum Supplies," "The Evolution and Distribution of Flowering Plants (Apocynaceae. Asclepiadaceae)"—further shows not only the diversity of his interests but also that he wrote with authority.

Dr. Macfarlane enjoyed membership in many learned societies here and abroad. In addition to the degrees from the University of Edinburgh he held an honorary LL.D., University of Pennsylvania, 1920, and an honorary Litt.D. from LaSalle College, 1929. He was married twice. His first wife, Emily Warburton Macfarlane, died in 1927. His second wife, Lily Wells Macfarlane, survives him, as do four children—Alistair, a teacher in the Philadelphia public schools; Norman, a physician; Archibald, in the State Department, Washington; and Mrs. Winifred Mair, Carlisle, Pa.

WALTER STECKBECK

UNIVERSITY OF PENNSYLVANIA

RECENT DEATHS

DR. HERMAN L. FAIRCHILD, professor of geology emeritus at the University of Rochester, died on November 29. He was ninety-three years old.

DR. FRANK E. LUTZ, chairman and curator of the department of insects and spiders of the American Museum of Natural History, New York City, and since 1909 a member of the scientific staff, died on November 27 at the age of sixty-four years.

ELMER SETH SAVAGE, professor of animal husbandry at Cornell University, died on November 20 at the age of sixty years.

DR. GEORGE H. BURROWS, who retired in 1942 as professor of chemistry and head of the department of the University of Vermont, died on November 22 in his sixty-eighth year. He had served on the faculty for thirty years.

DR. IRWIN BOESHORE, assistant professor of botany at the University of Pennsylvania, died on November

22 at the age of sixty years. At the time of his death he was president of the Botanical Society of Pennsylvania.

Franklin DeRonde Furman, who retired in 1941 as professor of mechanism and machine design and dean emeritus of Stevens Institute of Technology, died on November 21. He was seventy-three years old. He served for forty-eight years as a member of the faculty, thirteen years of which he was dean of the college.

Mrs. Adeline DeSale Link, assistant professor of chemistry at the University of Chicago, died on November 21. She was fifty-one years old.

Lieutenant Leonard A. Keyes, Jr., civil engineer, instructor in navigation at Mather Field, California, has been missing since July. Search for the airplane of which he was one of the officers has been abandoned. He was twenty-seven years old and was one of a group studying the latest use of radar in navigation. Colonel John W. Egan wrote to his parents: "Leonard had been on duty with this school for approximately fourteen months, and graduated with the highest honors ever made in the school. The loss of his services will be distinctly felt by the war effort, and extremely difficult to replace." Lieutenant Julian Taylor wrote: "I will say, as any member of the navigation school will say, that, if your son is lost, the navigation school has lost its most brilliant mind. The navigation manual which was to become a permanent navigation text lies half finished for lack of the driving force that was your son."

SCIENTIFIC EVENTS

ENLARGEMENT OF THE LABORATORY STAFF OF THE U. S. FOREST PRODUCTS LABORATORY

The requirements of the Army and Navy for wood and other forest products and the need for precise study of their properties and uses have been reflected in the quadrupling of the staff of the U. S. Forest Products Laboratory at Madison, Wis., in the past two years. This institution, maintained by the Forest Service of the U. S. Department of Agriculture in cooperation with the University of Wisconsin, is the largest and oldest research organization of its kind in the world. With a background of thirty-three years of experience in wood utilization problems ranging from strength and other analyses of wood properties to the chemical synthesis of wood into new substances of potential value, the Forest Products Laboratory has become established as the nation's center of such knowledge. Since the Pearl Harbor attack, all its resources have been directed toward research and investigations tied directly to the war effort.

Professional personnel was expanded from 91 on July 1, 1941, to 419 on September 30, 1943. The staff on the latter date consisted of forty-two chemists, six chemical engineers, a hundred engineers of other classifications—largely civil, aeronautical and structural—fifty-three technologists, forty-three industrial specialists, seven technical writers, two mathematicians, two physicists and 164 laboratory, engineering and physical science aids. In addition, 249 other employees—administrative, clerical, maintenance and craftsmen—brought the grand total number to 668. Noteworthy in this expansion has been the number of women employees, which increased from thirty-four to 191, including chemists, laboratory aids and other technical workers.

These employees are engaged in a variety of research, test work and consultation for various war agencies. Two entirely new divisions were created and staffed—the Division of Matériel Containers, concerned primarily with testing and designing of better wood and fiber-board containers for the Army Ordnance Department, Army Air Forces, Navy, War Food Administration and similar agencies charged with the packaging and shipment of war matériel of all kinds to overseas fighting fronts; and the Division of Technical Service Training, organized to conduct short specialized courses for Army, Navy and civilian personnel engaged in packaging work, aircraft wood inspection and maintenance of wood aircraft. Major aircraft research programs are being carried out in cooperation with the Army and Navy to develop design data for aircraft parts and set up specifications for wood, plywood, plastics, glues and finishes used in aircraft. The Navy Bureau of Ships is cooperating in a program of research designed to solve many problems of wood use with which it is concerned. Various projects are under way for the War Production Board to find new methods of getting improved service with wood or developing substitutes for other critical materials. Requests for information and testing work are daily received from other Government agencies as well as from many manufacturers confronted with difficult problems of conversion to wood use, ranging from producers of aircraft parts to makers of farm machinery, refrigerators and storage batteries.

THE PACIFIC MAP OF THE NATIONAL GEOGRAPHIC SOCIETY

The National Geographic Society has issued a new ten-color map of the Pacific Ocean and the Bay of

Bengal. This large wall map not only shows the world's largest and deepest ocean and the war's biggest single arena, but also covers the United States, Australia, half of India, eastern Asia, western South America and parts of Alaska and Canada.

The Pacific Ocean has most of the world's islands. The most important and strategic of these islands are shown on the map by fifty-six large-scale insets. These insets have been chosen to include those islands recently in the news and those expected to be scenes of action soon. Among them are Marcus, Tarawa, Wake, Paramushiro, Nauru, Attu, Kiska, New Britain, Makin, Funafuti, Truk and the Solomons.

Considerably more than half the world is pictured on the map. The Pacific Ocean is twenty-three times as large as the United States. There are fifteen distinct time belts, each belt with a clock at the bottom of the map indicating the local time when it is midnight in Greenwich. The map clearly shows that not all Pacific areas are on an hourly basis in relation to Greenwich. It is 1 : 22 P.M. in the Cook Islands when it is midnight in Greenwich.

Airline mileages are given, 1,035 of them, in a table of statute or land miles printed on the map. It can be seen at a glance that from Rabaul to Tokyo is 2,870 miles; from Kiska to Paramushiro, 948 miles. Nautical distances from port to port are indicated on the blue-dashed ship lines. Ocean currents are shown in blue-arrowed lines; ocean depth contours in brown lines; winds in brown-arrowed lines. Northern and southern limits of drift ice are indicated.

The map includes the Bay of Bengal, so as to include all possible sources of drives on Tokyo. Motor roads, under construction and completed, from India and Burma to China, are shown. Other important highways are the Russia-to-China desert route and the Alaska Military Highway.

Pre-war political alignments of the many Pacific Islands are identified by color: the traditional red for Great Britain's possessions, purple for France, green for the United States, yellow for the Netherlands, etc. Mandated areas and spheres of influence in the South Pacific are enclosed by red-dotted lines giving the names of the governing powers.

DESTRUCTION OF THE BERLIN HERBARIUM

ANNOUNCEMENT was made in SCIENCE for June 18, 1943, on the basis of private advice received from Sweden, that the herbarium and library of the Berlin Botanical Garden was destroyed by fire in a bombing raid on the night of March 1–2, 1943. This report is now confirmed by information received through the State Department, inquiries having been made at my request through the American legation at Bern, Switzerland. This report, dated September 1, states that the director of the Jardin Botanique at Geneva, Switzerland, has been officially informed that all its material on loan to the Berlin Herbarium was destroyed by fire and water; we may thus assume that all reference collections from American institutions on loan at Berlin were also destroyed. There is no evidence that any attempt was made, in Berlin, to safeguard its especially important botanical material, including its own thousands of types, and types borrowed from foreign institutions, by moving them to a safer place, as was done in London, and as has been done by a number of American herbaria. The loss of the Berlin herbarium is a catastrophe of major proportions to world botany. This herbarium, one of the largest and most important in the world, built up over a period of at least 175 years, contained the basic historical collections of Germany outside of those at Munich. Scores of thousands of type specimens from all parts of the world were thus destroyed.

It seems to be desirable to place on record some data regarding outstanding loans from American institutions in European centers of botanical research as of the present time, including a summary of presumed losses in the Berlin holocaust. I accordingly assembled the data from nine of our largest herbaria. The total losses of these American herbaria in the Berlin disaster are 4,393 specimens, varying from a high of 1,795 from the Gray Herbarium to a low of 164 from the Farlow Herbarium. The total number of specimens now outstanding in European centers is 30,966, with a high of 11,242 from Harvard University (Gray Herbarium, Farlow Herbarium, Arnold Arboretum), to a low of 145 specimens from the Missouri Botanical Garden. The Field Museum of Natural History outstanding loans total 1,567 sheets, the United States National Herbarium 6,807, the New York Botanical Garden, 8,750, the University of California 2,312 and the Missouri Botanical Garden 145; their Berlin loans are Farlow Herbarium 164, Gray Herbarium 1,795, Arnold Arboretum 394, New York Botanical Garden 675, U. S. National Herbarium 993, and the Field Museum of Natural History 373.

That other losses are to be expected is evident from a consideration of the European centers wherein the botanical institutions favored with loans from American institutions are situated, considering the very heavy bombing raids on certain cities in the following list: Berlin, Hamburg, Munich, Vienna, Königsberg, Heidelberg, Giessen, Jena, Breslau, Prague, Budapest, Lund, Stockholm, Uppsala, Utrecht, Leiden, Basel, Leningrad, Copenhagen, Helsinki, Geneva, Paris, Toulouse, Madrid, London, Edinburgh and Birmingham. In the total of 30,966 specimens now on loan from the nine American herbaria to institutions in the above cities, specimens on loan to institutions in

Japan, China, Java and Palestine are not included, and no account has been taken of other loans to various institutions in South America.

Inter-institutional loans of study material have been very largely developed within the present century, and these loans have been reciprocal as between European and other institutions and those in the United States. Under anything approaching normal conditions, losses are very rare, for modern transportation has been found to be safe. While the loss of certain selected collections from American institutions on loan in Berlin will be felt by workers in our herbaria, the really irreplaceable loss is that of the Berlin herbarium itself. Fortunately many of the types of earlier described species in the Berlin collection have been studied by various American botanists and records published; and again, thanks to the initiative of the Field Museum of Natural History, with the support of a grant from the Rockefeller Foundation, 15,800 Berlin types of tropical American species were photographed some years ago, and prints from the negatives may be secured. Thus this photographic record, plus the original descriptions, is now all that is available in thousands of cases to represent the species as originally described. The total number of negatives prepared for the Field Museum representing types and important historical specimens from tropical America in European herbaria is approximately 40,000.

E. D. Merrill

Director, Arnold Arboretum of
Harvard University

MEETINGS OF ENTOMOLOGISTS

The American Association of Economic Entomologists and the Entomological Society of America are holding in Columbus from December 7 to 9 a conference devoted to "Entomology and the War."

The two groups did not meet last year, but their present responsibilities are such as demand a conference on both health and food problems arising from the war.

According to Professor T. H. Parks, who is chairman of the local committee, the American Association of Economic Entomologists now has 1,575 members who have the responsibility of administering about fifteen million dollars of public funds annually on health, food and shelter problems—most of it on research and control operations.

Topics at the Columbus meeting concern "Medical Entomology in War-time" and "Agricultural Entomology in War-time." Taking part will be specialists in the medical and sanitary work of the U. S. and Canadian armed forces. Chemical control of insects affecting man's health and comfort will be discussed.

Officers of the American Association of Economic Entomologists are P. N. Annand, Washington, D. C., *president;* Avery S. Hoyt, Washington, *vice-president;* Ernest N. Cory, College Park, Md., *secretary-treasurer.*

Officers of the Entomological Society of America are C. P. Alexander, Amherst, *president;* Miriam A. Palmer, Fort Collins, Colo., *first vice-president;* William T. Davis, Staten Island, N. Y., *second vice-president;* and Clarence E. Mickel, St. Paul, Minn., *secretary-treasurer.*

THE INFORMATIONAL SERVICE OF THE DIVISION OF MEDICAL SCIENCES OF THE NATIONAL RESEARCH COUNCIL

Professor Ross G. Harrison, chairman of the National Research Council, has announced the appointment of Major General James Carre Magee, Medical Corps, U. S. Army, retired, as executive officer of the Informational Service of the Division of Medical Sciences. This service has been established by the National Research Council under the recent grant of the Johnson and Johnson Research Foundation, by which the sum of $75,000 was made available to the council for the period ending June 30, 1945. The purpose of the grant is to enable the council to assemble and disseminate, as far as possible, medical information pertaining to the war effort.

General Magee has had a distinguished record in the Medical Corps of the Army. A graduate of Jefferson Medical College in 1905, he has spent his entire professional life in the medical service of the Army. He was assigned to the Philippines before the outbreak of the first World War and then recalled for European duty from 1917 to 1919. He was appointed Surgeon General of the Army in 1939, and on May 31, 1943, he was retired on completion of the four-year term of duty. It was under his direction that the Medical Corps was enormously expanded to meet the demands of the present war and the program of service adopted which has led to the remarkable health record of the Army. General Magee holds the honorary degree of doctor of science from Jefferson Medical College, and was recently awarded the Distinguished Service Medal for outstanding accomplishments as Surgeon General.

General Magee, who assumed his duties on December 1, will devote full time to the organization of a central office in the National Research Council which will collect medical reports and records, widely dealing with military medical practice, civilian practice as affected by the war, medical education and research and the distribution of diseases. The materials collected will, so far as military necessities permit, be made available by publications, summaries and notes.

ROYAL SOCIETY MEDALISTS

The King of England has approved the recommendations made by the council of the Royal Society for the award of the two Royal Medals for the current year as follows:

To Sir Harold Spencer Jones, F.R.S., for his determination of the solar parallax and of other fundamental astronomical constants.

To Dr. E. B. Bailey, F.R.S., for his distinguished contributions to the knowledge of mountain structure and his studies on the tectonics of vulcanism.

The following awards of medals have been made by the president and council of the Royal Society:

The Copley Medal to Sir Joseph Barcroft, F.R.S., for his distinguished work on respiration and the respiratory function of the blood.

The Davy Medal to Professor Ian M. Heilbron, F.R.S., for his many notable contributions to organic chemistry, especially to the chemistry of natural products of physiological importance.

The Sylvester Medal to Professor J. E. Littlewood, F.R.S., for his mathematical discoveries and supreme insight in the analytical theory of numbers.

The Hughes Medal to Professor M. L. E. Oliphant, F.R.S., for his distinguished work in nuclear physics and mastery of methods of generating and applying high potentials.

John D. Griffith Davies,
Assistant Secretary

SCIENTIFIC NOTES AND NEWS

At the informal dinner of the National Academy of Sciences on November 22 the Daniel Giraud Elliott Medal for 1937 was presented to Dr. George H. Parker, of Harvard University, and the Mary Clark Thompson Medal for 1941 to Professor D. M. S. Watson, Jodrell professor of zoology and comparative anatomy of University College, London. Since Dr. Watson was unable to be present in person the British Ambassador accepted the invitation of the academy to be its guest and to receive the medal for him.

Dr. Henry van der Schalie, assistant curator of mollusks at the museum of zoology of the University of Michigan, has been awarded the Walker Prize of the Boston Society of Natural History. The value of the prize was increased this year from $50 to $100 in recognition of the excellence of Dr. van der Schalie's work on "The Value of Mussel Distribution in the Tracing of Stream Confluence."

Dr. Herman L. Kretschmer, president-elect of the American Medical Association, received on October 18 the honorary degree of doctor of science from the School of Medicine of Marquette University, Milwaukee. He gave the commencement address, which was entitled "Medical Education, the War and You."

The House of Representatives in anticipation of the fortieth anniversary of the Wright brothers' pioneer flight at Kitty Hawk, N. C., passed and sent to the Senate on November 24 a resolution expressing the nation's "gratitude and respect."

Dr. Reuben M. Strong, professor of anatomy and chairman of the department at Loyola University School of Medicine, Chicago, and Dr. Thesle T. Job, professor of anatomy, who have completed twenty-five years as members of the faculty, were honored at a dinner given on October 31 by the student body.

Hubert M. Turner, associate professor of electrical engineering at Yale University, has been elected president of the Institute of Radio Engineers, an international organization with more than 11,000 members located in all parts of the world.

Dr. A. C. Furstenberg, dean of the Medical School of the University of Michigan, has been appointed president-elect of the Association of American Medical Colleges. He will assume the presidency in October, 1944.

The vacancy caused by the sudden death of Sir Beckwith Whitehouse, president of the British Medical Association, has been filled by the appointment of Lord Dawson, who was president at the centenary meeting.

Lewis M. Turner, who has been with the U. S. Forest Service since 1937, has become dean of the School of Forestry and Range Management of Utah State College at Logan.

Dr. Arthur J. Gatz, assistant professor of zoology at Carleton College, has been appointed assistant professor of anatomy in the School of Medicine of Loyola University in Chicago.

Dr. Carl E. Guthe, professor of anthropology and director of museums of the University of Michigan, has been appointed director of the New York State Museum at Albany, N. Y. He will assume his new work on March 1. He succeeds Dr. Charles C. Adams, who retired last summer.

Professor W. A. Seaman, of the Michigan College of Mining and Technology, has been appointed curator of the mineralogical museum named after his father, the late Professor A. E. Seaman, who contributed greatly to its establishment more than fifty years ago. The museum contains 20,000 display specimens representing more than 1,100 of the 1,600 recognized mineral species. Its nucleus consists of gifts made in the 1880's and 1890's by Dr. Lucius L. Hubbard, Dr. George A. Koenig and Professor A. E. Seaman, who was head of the department of geology of the college from 1899 to 1928 and who served as curator of the museum from 1928 to 1937, the year of his death.

The Norwich Pharmacal Company has made an appropriation of $2,500 to establish two fellowships at Syracuse University for work on antibacterial agents under the direction of Dr. P. M. Ruoff. The fellowships have been awarded to R. D. Sprenger and F. W. Staab.

Dr. George K. Anderson, technical aide of the Division of Medical Sciences of the National Research Council, Washington, D. C., has become secretary of the Council on Foods and Nutrition of the American Medical Association.

Dr. Harold S. Adams, general superintendent of the Upjohn Company, has been elected a vice-president. Dr. E. Gifford Upjohn has been appointed medical director.

Dr. David A. Kribs, assistant professor of botany of the Pennsylvania State College, has been appointed director of research and head of the school for wood airplane construction, designed for engineers and supervisors in inspection and production, of the Fairchild Aircraft, Burlington, N. C.

Dr. Joseph C. Bequaert and Dr. Everett P. Veatch, of the American Foundation of Tropical Medicine, left on November 16 by plane for Liberia to make a study of the incidence of sleeping sickness among the natives of northeast Liberia and French and British Guiana.

The British Ministry of Agriculture, according to *The Times*, London, has selected the following delegates to visit the United States to report on American farming conditions and their lessons for British agriculture: Tom Peacock, a former president of the National Farmers' Union; F. Rayns, executive officer of the Norfolk War Agricultural Executive Committee, and A. R. Wannop, North of Scotland Agricultural College.

Dr. Harvey N. Davis, head of the Office of Production Research and Development, which operates under the War Production Board in Washington, and Dr. Donald B. Keyes, chief of the chemical industries branch, are on a mission to Great Britain. They will discuss with the Ministry of Production and other Government departments the exchange of technical information between the two countries, and they hope to encourage experts on both sides of the Atlantic to inspect each other's factories and factory operations.

Dr. Clarence C. Little delivered on November 16 the annual Barnard Free Skin and Cancer Hospital Lecture before the St. Louis Medical Society. He spoke on the "Influence of Heredity in Human Cancer."

Early in November Dr. Carl G. Hartman, head of the department of zoology and physiology and chairman of the Biological Division of the University of Illinois, delivered a series of lectures in California. Before the Pacific Coast Society of Obstetrics and Gynecology, meeting in San Francisco, he spoke on "Recovery of Primate Eggs and Embryos" and on "Regenerative Capacity of the Monkey Uterus"; at the Institute of Experimental Biology, University of California, Berkeley, on "Some New Cell Types in the Vaginal Smear of the Rat"; before the Research Club, Stanford University, on "Instinctive Behavior as Illustrated by the Solitary Wasp" (with motion pictures); before the Los Angeles Gynecological Society, on "The Normal and the Hyperactive Ovary in the Menstrual Cycle and in Hyperplasia."

Applications for research fellowships in medicine, dentistry and pharmacy in the University of Illinois are now being considered for the year beginning September 1, 1944. Appointments to these fellowships will be announced on January 1. Candidates must have completed a training of not less than eight years beyond high-school graduation. The fellowship carries a stipend of $1,200 per calendar year with one month's vacation. Application blanks and further information may be secured from the Secretary of the Committee on Graduate Work in Medicine, Dentistry and Pharmacy, 1853 West Polk Street, Chicago 12, Illinois.

The Society of the Sigma Xi will hold its forty-fourth annual convention on December 4, in Chicago at the Shoreland Hotel. Due to wartime conditions, the necessary business of the society, with ninety chapters in institutions of higher learning and forty alumni clubs in leading cities, will be confined to a single day. Attendance will be limited to delegates from chapters and clubs. Petitions for the establishment of Sigma Xi chapters at five more universities will be received and acted upon at the national convention. Charters are being requested for chapters at Emory University, Atlanta; North Carolina State College, Raleigh; St. Louis University; Vanderbilt University, and Wayne University, Detroit. Dr. Harlow Shapley, president of the society and director of Harvard College Observatory, delivers the twenty-second annual lecture on December 3, in the University of Chicago's Mandel Hall, speaking on "Star Clusters and the Dimensions of the Galaxies." Dr. Anton J. Carlson, who is the Hixson distinguished service professor of physiology, emeritus, at the University of Chicago, makes the introduction.

The autumn meeting of the Utah Academy of Science, Arts and Letters was held at the Utah State Agricultural College on November 13. A special feature of the program was an address on "Experimental

Nutritional Deficiencies" by Dr. M. M. Wintrobe, head of the department of internal medicine of the University of Utah. Addresses at the general sessions were made also by Dr. N. A. Pedersen, dean of arts and sciences, Utah State Agricultural College; by Dr. E. E. Erickson, dean of arts and sciences of the University of Utah; by Dr. A. M. Woodbury, professor of biology, University of Utah, and by Dr. O. W. Israelsen, professor of irrigation and drainage, Utah State Agricultural College. Twenty-one contributed papers were read at three sectional meetings. The officers of the academy for the current year are: *President,* R. H. Walker, dean of agriculture and director of the Agricultural Experiment Station, Utah State Agricultural College; *First Vice-president,* Walter P. Cottam, professor of botany, University of Utah; *Second Vice-president,* Vasco M. Tanner, professor of zoology, Brigham Young University, and *General Secretary,* I. O. Horsfall, director of the Extension Division of the University of Utah.

THE National Malaria Society met conjointly with the Southern Medical Association in Cincinnati, from November 16 to 18, under the presidency of Brigadier General James S. Simmons, M. C., A. U. S. A Symposium on the National Program for the Control of Malaria was held on November 18. The following officers were elected to serve during 1944: *Honorary President,* Dr. Frederick L. Hoffman, Los Angeles; *President,* G. H. Bradley, Atlanta; *President-elect,* H. A. Johnson, Memphis; *Vice-president,* Stanley Freeborn, Atlanta; *Secretary-Treasurer,* Dr. Mark F. Boyd, Tallahassee; *Member of the Editorial Board,* Dr. Lloyd Roseboom, Baltimore, and *Representative to the Council of the American Association for the Advancement of Science,* Dr. E. C. Faust, New Orleans.

AT the sixteenth annual meeting of the Central Society for Clinical Research held in Chicago on November 5, the following officers were elected for the year 1943–44: *President,* Dr. Cecil J. Watson, Minneapolis; *Vice-president,* Dr. Willis M. Fowler, Iowa City; *Secretary-Treasurer,* Dr. Carl V. Moore, St. Louis. *Councilors:* Drs. Harold Feil, Cleveland; F. W. Madison, Milwaukee; Ovid O. Meyer, Madison; Irvine H. Page, Indianapolis; William A. Thomas, Chicago, and John W. Scott, Lexington.

CLIFTON E. MACK, director of procurement, U. S. Treasury Department, will speak at the annual luncheon meeting of the American Standards Association to be held on December 10 at the Hotel Roosevelt. His address will deal with using standards to bring government requirements more nearly into line as a part of the American industrial system. Mr. Mack is in charge of all government lend-lease purchasing. This meeting marks the twenty-fifth anniversary of the founding of the American Standards Association. Started as a result of the production problems of the last war, the association has in the past year completed more than forty emergency jobs for the armed services and industry, and is engaged on many others. R. E. Zimmerman, president of the organization, will give a brief address on post-war changes and developments. H. S. Osborne, chairman of the Standards Council, will report on the year's work. Because of the special nature of this occasion, in commemoration of its twenty-five years of service to industry and government, the American Standards Association extends a cordial invitation to all who wish to attend, whether they are members of the association or not. Further information in regard to the meeting may be obtained from the American Standards Association, 29 West 39th St., New York 18, N. Y.

THE Long Island Biological Association, Cold Spring Harbor, N. Y., has received from Mrs. Henry W. deForest, in addition to her gift of nine acres with buildings and her interest in the Sand Spit, a deed to some seven acres of land, adjacent to the first parcel, on which stands a residence which will serve as the home of the director of the laboratory.

THE *Journal* of the American Medical Association reports that a Frank Wister Thomas professorship of medicine will be established at the School of Medicine of the University of Pennsylvania under the will of Mrs. Maria G. B. Thomas of Philadelphia, who died on September 15. The professorship will be a memorial to Mrs. Thomas's husband, Dr. Frank W. Thomas, who died on January 19, 1928. According to the will, most of the $200,000 estate is left ultimately to create the new chair. The residue is bequeathed to the university toward the endowment, and trust funds amounting to $50,000 will be added to it as the beneficiaries die, until $200,000 is accumulated. The holder of the professorship shall be the person who is recognized by the trustees as the head or chief professor of medicine at the medical school. If the endowment exceeds the amount necessary to establish the professorship, or if the chair becomes temporarily vacant, one or more temporary Frank Wister Thomas fellowships in medicine will be set up. Any excess over the $200,000 limit fixed for the professorship is bequeathed to Germantown Dispensary and Hospital.

THE *Journal* of the American Dental Association states that a list of minimum standards for dental departments in hospitals has been established by the American College of Surgeons. This list supplements the fifteen minimum standards already established for distinct hospital services and departments and is a part of the hospital standardization program of the American College of Surgeons.

DISCUSSION

ANGIOTONIN OR HYPERTENSIN

IN a letter to SCIENCE, Page, Helmer, Plentl, Kohlstaedt and Corcoran[1] suggest the term "renin substrate" (α 2 globulin) for hypertensinogen or renin-activator. Uniformity of terminology would be desirable, as it has become rather confusing, due to the fact that some substances have several names as follows:

Buenos Aires group	*Indianapolis group*	*Lewis and Goldblatt*[4]
Hypertensin	Angiotonin	Hypertensin
Hypertensinogen	Renin-activator	Hypertensinogen
Hipertensinase	Angiotonase[2]	Hypertensinase
No equivaent	Angiotonin-activator[3] Angiotonin-inhibitor[3] Renin-inhibitor[3]	No equivalent

The last three terms have no equivalent in the Buenos Aires group terminology because the existence of the substances or actions implied have not been conclusively proved.

As to which term should be used, angiotonin or hypertensin, it is a matter of personal judgment. No priority can be claimed by either group, as the discovery of this substance was practically simultaneous.

The objection against hypertensin because it "implies a participation in hypertension and an effectiveness in hypotension" would perhaps be valid for commercial use, a point which we have never considered. The term hypertensin appropriately describes its action of increasing blood pressure and, as Lewis and Goldblatt[4] point out, "if it is eventually proved" to be the "cause of the elevated blood pressure, then the specific term hypertensin . . . will be more pertinent than the non-specific term angiotonin." That it has a definite and important participation in renal experimental hypertension is, we believe, unquestionable.

The terminology of the Buenos Aires group "in which renin the enzyme acts on hypertensinogen . . . to liberate hypertensin(e) the vasoconstrictor (and pressor), which may be destroyed by hypertensinase, has a clarifying unity which, in a sense, is lacking to the parallel succession of renin, renin activator, angiotonin and angiotonin inhibitor."[5] To us it has the advantage of being simple, logical, of forming a homogeneous group and of describing the action or origin of the substances.

The term renin-activator should be abandoned because it conveys an erroneous idea. The term hypertensinogen is perfectly correct: in fact, the suffix "ogen" is used to denote "giving rise to" (glycogen gives glucose, fibrinogen, fibrin, caseinogen, casein, etc.). As to the new term proposed "renin substrate (α 2 globulin) it should be pointed out: (1) that the enzymatic nature of the reaction has not "been established beyond a doubt."[1] There are several facts which make it probable, as we have repeatedly pointed out. But the matter can only be settled by experimenting with known concentrations of the pure substances. The fact that reaction approximately follows the equation for a first order reaction[6] can not be taken as a proof. (2) Moreover, if renin is really an enzyme, it might act on more than one substrate. For instance, pepsin acts on many proteins and calling one of them pepsin substrate would not identify it. (3) Adding another term (α 2 globulin) which describes its electrophoretic behavior would not help much. Moreover, it is not yet known whether hypertensinogen is all or part of the α 2 globulin fraction of serum, or only accompanies this fraction, and it remains to be proved that this fraction always contains hypertensinogen.

The addition of a new long and not too happy term for a substance, which has already four, would hardly simplify the terminology.

E. BRAUN MENENDEZ
J. C. FASCIOLO
B. A. HOUSSAY
L. F. LELOIR
J. M. MUÑOZ
A. C. TAQUINI

THE TRIPTANE PROCESS

TRIPTANE is the most powerful hydrocarbon known for use in internal combustion engines. Its antiknock properties are of such magnitude that no commercial engine has been built which is capable of utilizing the full power value of pure triptane. When used as a component of aviation gasoline, it greatly enhances the performance of present-day aircraft engines and makes possible the design of future engines of even greater power and efficiency.

Although its existence has been known for years and some of its physical properties have been determined, triptane has been a laboratory curiosity because the known methods of producing it involved the classical but impractical Grignard reaction, or zinc di-methyl as a reactant. Reported costs for producing triptane in very small amounts in the laboratory by these methods have run to such fantastic figures as over $3,000.00 per gallon. It has been reported that a batch of several hundred gallons of triptane was produced within the past two years for experimental purposes at a reported figure of $40.00 per gallon. Even if the cost did not preclude the use of triptane for war purposes, the consumption of critical materials needed to produce it by previously known methods would not justify its production.

---

[1] I. H. Page, O. M. Helmer, A. A. Plentl, K. G. Kohlstaedt and A. C. Corcoran, SCIENCE, 98: 153, 1943.

[2] I. H. Page, O. M. Helmer, K. G. Kohlstaedt, G. F. Kempf, A. C. Corcoran and R. D. Taylor, *Ann. Int. Med.*, 18: 29, 1943.

[3] I. H. Page and O. M. Helmer, *Jour. Exp. Med.*, 71: 495, 1940.

[4] H. A. Lewis and H. Goldblatt, *Bull. N. Y. Acad. Med.*, 18: 459, 1942.

[5] Editorial. *Jour. Am. Med. Asn.*, 120: 923, 1942.

[6] A. A. Plentl and I. H. Page, *Jour. Biol. Chem.*, 147: 135, 1943.

The authors, working with materials at hand and available in quantity, made the discovery which makes possible the commercial production of this fuel. They, together with the technical staff of the Universal Oil Products Company, made possible the production of triptane at an estimated selling price of less than $1.00 per gallon.

The process consists of two steps. The second step of the process involves the formation of triptane from a selected charging stock produced in the first step. Based on the material charged to the second step, liquid recoveries of over 90 per cent. are obtained of which over 50 per cent. is triptane.

The process, when operated to make the largest quantity of triptane available as a blending agent, yields two other valuable hydrocarbons, in themselves of great value in aviation blends. These hydrocarbons, 2,3-dimethylbutane and 2,3-dimethylpentane, are superior to alkylate as blending agents for aviation gasoline.

Table 1 gives the physical properties of individual hydrocarbons produced by this process:

TABLE 1

Compound	B.P., °C.	M.P., °C.	Refractive index, n_D^{20}	Specific gravity
2,3-dimethylbutane ..	58.0	−128.8	1.3750	0.6620
2,2,3-trimethylbutane . (triptane)	80.8	− 25.0	1.3894	0.6901
2,3-dimethylpentane ..	89.7	....	1.3920	0.6944

The relatively high freezing point of pure triptane does not preclude its use in aviation fuels. Blends containing up to about 85 per cent. triptane do not freeze above −78° C. (−108° F.).

The product of the reaction is saturated and free of impurities so that no additional refining treatment is necessary to permit its use in aviation fuels. The process has been operated to date for 300 hours in a pilot plant with no indication of decline of catalyst activity.

No new or unusual materials are needed for the reaction or process. The raw materials are condensable gases produced in petroleum refineries as by-products of catalytic and non-catalytic cracking or reforming of petroleum oils. The catalysts are readily available in large quantities. No special equipment or materials used in the process plant are necessary other than regular equipment employed in refineries. The temperatures and pressures employed are well within refinery experience.

VLADIMIR HAENSEL
V. N. IPATIEFF

UNIVERSAL OIL PRODUCTS COMPANY,
CHICAGO

CONCERNING TRANSLATIONS OF GEOLOGICAL TEXTS FOR SOUTH AMERICAN STUDENTS

IN a recent issue of SCIENCE (September 3) there is a letter concerning the translation of American textbooks of geology for use in South America. It would be very fine to have two or three with which I am well acquainted translated, but I would make the suggestion that, if this were done, illustrations from South America be included. That means that some one from one of the South American universities should work in collaboration with the translator.

I also wish to call the attention of those who might be interested in this subject to the fact that there is a very excellent two-volume work on the geology of Argentina by Windhausen, in Spanish. I consider this an excellent book, and I doubt if the people in Argentina would prefer a translation of a North American text to this one.

WARREN D. SMITH

UNIVERSITY OF OREGON

SCIENTIFIC BOOKS

CHEMICAL SPECTROSCOPY

Chemical Spectroscopy. By PROFESSOR WALLACE R. BRODE. Second edition. xi + 677 pp. Illustrated. New York: John Wiley & Sons. $6.50.

THE second edition of this book closely follows the general plan of the first. All phases of spectroscopy are considered, as the chapter headings show. The illustrations are very numerous, and some which were indistinct in the first edition are now very satisfactory; *e.g.*, Fig. 3.35, p. 64; Fig. 4.2, p. 71; Fig. 4.7, p. 86. Some of the photographs of apparatus, too, are clearer.

The valuable lists of references have been brought up to date; it is interesting that a total list of 259 references in the first edition is now expanded to 415.

The book will be of particular use to the practical man, and to him it can be warmly recommended. Theoretical discussions are less happily dealt with, however. At the opening of the chapter on "Resonance and Chemical Structure," a preliminary discussion of resonance is given which can convey but very little to those unacquainted with the subject, since no adequate definition or description of resonance is given. After a digression in which the electronic theory of valency is reviewed, a definition of resonance is provided which is open to serious objections.

It is implied—particularly in the use of the expression "equilibrium mixture"—that distinct molecular species corresponding to the extreme electronic formulae of resonating compounds are capable of independent existence.

The word resonance undoubtedly suggests some kind of rapid oscillation or vibration to many people. Nevertheless, no such change, quick or slow, is actually present, and a resonating compound is not a mixture. It seems unfortunate to add to the confusion by using the word "vibrator" (p. 259) for a part of a molecule which is capable of resonance.

The reader is cautioned aginst confusing resonance with tautomerism (p. 137), yet a typical tautomeric equilibrium is given in Fig. 6.11c (p. 143) as an example of resonance. Similar confusion is reflected in Fig. 8.41. In Fig. 6.11c, too, the equation purporting to show resonance within the molecule of quinone is obviously incorrect; the dipolar structure shown has two positive charges.

The relationship implied by the caption for Fig. 9.29 is at variance with the text. If the unsymmetrical dye shows a deviation in λ max., it would absorb at some shorter wave-length than the mean of the values of λ max. of the related symmetrical dyes, whereas the caption is so worded that the unsymmetrical dye appears to absorb at *longer* wave-length than either of the symmetrical dyes. Actually none of these curves is that of a dye which contains a thiazole ring; they are the spectra of 1,1′-diethyl-2,2′-, 2,4′- and 4,4′-carbocyanine iodides, taken in the order A, B, C. Incidentally, the term "degeneracy" is used in Fig. 9.30 where "deviation" is meant.

Aside from these criticisms, however, this volume contains such a wealth of material that it may confidently be expected to appeal to a wide circle of readers.

L. G. S. BROOKER

EASTMAN KODAK COMPANY,
ROCHESTER, N. Y.

TEMPERATURE

Temperature Measurement. By ROBERT L. WEBER. Frontisp., x + 171 + 6 pp.; 3 pls. Ann Arbor, Mich.: Edwards Brothers, Inc. $2.50. 1941.

THE scope of the book is considerably broader than the title indicates; it might better have been called "Heat Measurements." There are chapters on heat transfer, radiation, calorimetry, thermal analysis and elementary thermodynamics. From the outside reader's point of view this is a defect, for none of these subjects can be treated in such brief chapters in more than a very condensed and—for the elementary student—inadequate way. On the other hand, the author, who is on the teaching staff of the School of Chemistry and Physics of Pennsylvania State College, may have found that his students were not getting, from other physics courses, a point of view or insight that he wished them to have on some of these subjects, and may have inserted them for local and practical reasons. Thirty pages are devoted to laboratory experiments intended for instruction.

The chapters that do hew to the line cover expansion thermometry, resistance thermometry, thermo-electric pyrometry, radiation (including optical) pyrometry, special methods of temperature measurement, measurement of extreme temperatures, the International Scale, temperature recorders and temperature control. The chapter on control, six pages long, can hardly do more than tell the student that there is such a thing as automatic control and hint at its complexity. It is a subject still badly in need of a good write-up.

The job of offset printing from typescript copy is quite satisfactory with the exception of illustrations of the half-tone variety, which are not well adapted to this method of reproduction.

This looks like a book that will be useful to any teacher or student concerned with measurements of energy and temperature.

ROBERT B. SOSMAN

RESEARCH LABORATORY,
UNITED STATES STEEL CORPORATION,
KEARNY, N. J.

SPECIAL ARTICLES

DESTHIOBIOTIN[1]

DURING the work leading to the proof of structure of biotin,[2] a procedure devised for the hydrogenolysis of organic sulfides[3] was applied to biotin methyl ester.[4] The resulting product was named *desthiobiotin* methyl ester, and was formed from biotin methyl ester by the replacement of the sulfur atom in the molecule by two hydrogen atoms, as indicated by the accompanying structures.

---

[1] The authors wish to thank Dr. R. T. Major and the Research Staff of Merck and Company, Incorporated, for supplies of biotin. The authors also wish to express their appreciation to Dr. J. R. Rachele and R. C. Funk, Jr., for the microanalyses, and to Miss Carol Tompkins and Mrs. Glenn Ellis for technical assistance in the bioassays.

[2] V. du Vigneaud, SCIENCE, 96: 455, 1942.

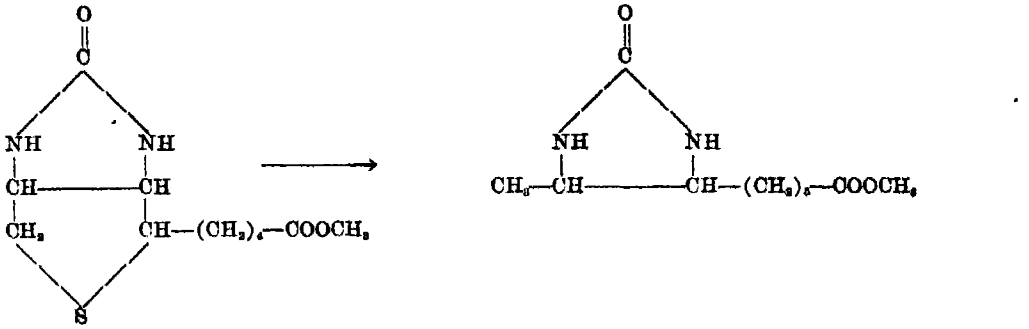
[3] R. Mozingo, D. E. Wolf, S. A. Harris, and K. Folkers, *Jour. Am. Chem. Soc.*, 65: 1013, 1943.

[4] V. du Vigneaud, D. B. Melville, K. Folkers, D. E. Wolf, R. Mozingo, J. C. Keresztesy and S. A. Harris, *Jour. Biol. Chem.*, 146: 475, 1942.

Vigorous treatment of desthiobiotin methyl ester with acid or alkali yielded ζ,η-diaminopelargonic acid which by treatment with phenanthrenequinone yielded the same quinoxaline derivative as synthetic ζ,η-diaminopelargonic acid.[4]

In line with our study of the relationship of structure to the biological activity of biotin, which we have under way, an investigation of the biological effects of desthiobiotin was undertaken. While all phases of the investigation of this compound are not yet complete, we feel it worthwhile to make a preliminary report at this time, in view of the surprising yeast-growth activity of this compound. We have found that desthiobiotin is equally as effective as biotin in stimulating the growth of *Saccharomyces cerevisiae*, and produces a readily noticeable growth effect in a concentration of less than 1 part in 400,000,000,000.

The previously published method[4] of preparing desthiobiotin methyl ester by refluxing an alcoholic solution of biotin methyl ester with Raney nickel for several hours was found unsatisfactory for the preparation of the pure compound. Various samples of desthiobiotin methyl ester prepared in this manner showed differences in melting point and varying degrees of biological activity. Separation from undesirable side-products was difficult. In no case did we obtain a product with an activity approaching the activity reported here for the pure product. Treatment of biotin (free acid) under the same conditions was equally unsatisfactory.



We have now found that by carrying out the desulfurization of biotin in aqueous *alkaline* solution and for a short period of time, excellent yields of pure desthiobiotin can be obtained. In this way we have prepared desthiobiotin of constant melting point and biological activity. The compound was characterized by analysis and by conversion to ζ,η-diaminopelargonic acid.

50 mg of biotin were dissolved in 15 cc of 0.5 per cent. Na_2CO_3, and approximately 2.5 gm of Raney nickel[3] prepared at 50° were added. The mixture was heated with continuous stirring at 75° for 15 minutes. At the end of this time, the nickel was centrifuged down and washed with 2 cc of 0.5 per cent. Na_2CO_3 solution and twice with 2 cc of water. The combined solutions were acidified to Congo red with HCl and concentrated to 2–3 cc. Fine needles separated from the solution during the last stages of concentration. These were removed and washed with water. This fraction, micro m.p. 152–7°, weighed 36 mg. By concentration of the mother liquors and then continuous ether extraction for 5 hours an additional 6 mg, m.p. 147–152° were obtained. Two recrystallizations of the crude desthiobiotin from water yielded the pure compound, m.p. 157–8°.

$C_{10}H_{18}O_3N_2$	Calculated,	C 56.04,	H 8.47,	N 13.08
214.3	Found,	" 56.30,	" 8.58,	" 13.12

The desthiobiotin was tested for its biotin activity by the yeast-growth method of biotin assay,[5] in which Strain 139 *Saccharomyces cerevisiae* was used. Under our conditions of assay, both biotin and desthiobiotin produced similar growth curves with a half-maximum growth increase at a concentration of 1 part in 4.75×10^{10}. Desthiobiotin is therefore, on a weight basis, fully as active as biotin for this strain of yeast. On a molarity basis, desthiobiotin, because of its slightly lower molecular weight, is somewhat less effective than biotin as a yeast-growth factor.

In conformity with our hypothesis that the urea grouping of biotin is essential for the combination of biotin with avidin,[6] we find that the yeast-growth activity of desthiobiotin is also inhibited by avidin.

That such a deep-seated change in the structure of the biotin molecule should result in a compound of such a high order of biological activity is indeed surprising. However, that desthiobiotin can not replace biotin in the media for all micro-organisms which require biotin is demonstrated by our finding that desthiobiotin does not stimulate the growth of *Lactobacillus casei*. The effect of desthiobiotin on various other micro-organisms and on mammals and birds remains to be investigated.

---

[5] E. E. Snell, R. E. Eakin and R. J. Williams, *Jour. Am. Chem. Soc.*, 62: 175, 1940.

[6] V. du Vigneaud, K. Dittmer, K. Hofmann and D. B. Melville, *Proc. Soc. Exp. Biol. and Med.*, 50: 374, 1942.

Donald B. Melville
Karl Dittmer
George Bosworth Brown
Vincent du Vigneaud

Department of Biochemistry,
Cornell University Medical College,
New York, N. Y.

RATIONS FOR THE STUDY OF THE RELATIVE NUTRITIVE VALUE OF FATS AND OILS

Data have shown butter fat to have superior growth-promoting value for the albino rat as compared to certain vegetable oils: (1) on a diet of mineralized raw skimmed milk into which the various fats and oils have been homogenized;[1] (2) on a basal diet of ether-extracted mineralized skim milk powder[2]; and (3) on a synthetic type ration containing *lactose 32,* casein (fat free) 28, liver extract 1–20[3] 6, salts 6, fat 28, and vitamins.[2]

Since at the present time there is great interest in the nutritional value of fats, we felt that our data would be of aid to workers in the field. In the present study weanling albino male rats of the Sprague-Dawley strain were given *ad libitum* a basal diet of the following composition: *lactose 48,* casein (fat free) 20, fat 28 and salts IV[4] 4 per cent., respectively. Vitamins added per 100 gm of ration: thiamine 0.5 mg; riboflavin 0.5 mg; nicotinic acid 0.625 mg; pyridoxine 0.625 mg; calcium pantothenate 5.0 mg; p-amino benzoic acid 30.0 mg; inositol 100 mg; choline 250 mg; β-carotene 0.56 mg; α-tocopherol 2.24 mg; calciferol 0.014 mg; and 2-methyl-1, 4-naphthaquinone 0.21 mg. The results recorded in Table 1 show the average number of grams gained during the period of six weeks by rats fed butter fat or corn oil on both the 32 per cent. lactose ration[2] and on the 48 per cent. lactose ration. Rough and discolored fur coats, blood-stained noses and scaly paws (when the humidity was not abnormally high) were noted in the rats fed the 48 per cent. lactose ration containing corn oil. Thus greater differences were found between the nutritive value of butter fat and corn oil in the young rapidly growing rat when the lactose content of the ration was raised from 32 to 48 parts, and the liver concentrate was omitted entirely.

TABLE 1

	32 per cent. lactose ration	48 per cent. lactose ration		
Experiment No.	53, 54, 62	78	81	84
No. of rats on each fat	15	6	6	6
Butter fat. Gain in six weeks	197 gm	164 gm	174 gm	156 gm
Corn oil. Gain in six weeks	168 gm	124 gm.	131 gm	118 gm
Difference	29 gm	40 gm	43 gm	38 gm

TABLE 2

Diet exclusive of fat	Fat	Average gain in gm in six weeks
Skim milk powder 70	Butter fat 30	219*
Skim milk powder 70	Corn oil 30	200*
Difference		19
Skim milk powder 50, lactose 20	Butter fat 30	214
Skim milk powder 50, lactose 20	Corn oil 30	172
Difference		42
Skim milk powder 50, dextrose 20	Butter fat 30	221
Skim milk powder 50, dextroso 20	Corn oil 30	217
Difference		4

* Average of 12 male rats.

Likewise, an increased level of lactose on a skim-milk powder basal ration accentuates the difference in the nutritive value of butter fat and corn oil. The ration was prepared as described,[2] and the experiment set up as shown in Table 2. These data represent the average growth over a six-week period by six male rats, in each group.

It is apparent that lactose has an as yet unknown effect on intestinal conditions which is counteracted by butter fat but not by corn oil.

R. P. Geyer
R. K. Boutwell
C. A. Elvehjem
E. B. Hart

Department of Biochemistry,
College of Agriculture,
University of Wisconsin

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE FRACTIONAL CEPHALIN-CHOLESTEROL FLOCCULATION TEST

In a recent communication, Bruger[1] proposed a fractional cephalin-cholesterol flocculation test to be used as an index of increasing or decreasing hepatic pathology. The modification consisted in the utilization of increasing dilutions of serum with saline and noting the flocculation according to the procedure originally described by Hanger.[2] The data presented in support of the modified test does show that, when repeated at various intervals, changes occur which could be interpreted as indicative of increasing or decreasing dysfunction.

---

[1] E. J. Schantz, C. A. Elvehjem and E. B. Hart, *Jour. Dairy Science,* 23: 181, 1940.

[2] R. K. Boutwell, R. P. Geyer, C. A. Elvehjem and E. B. Hart, *Jour. Dairy Science,* 26: 429, 1943.

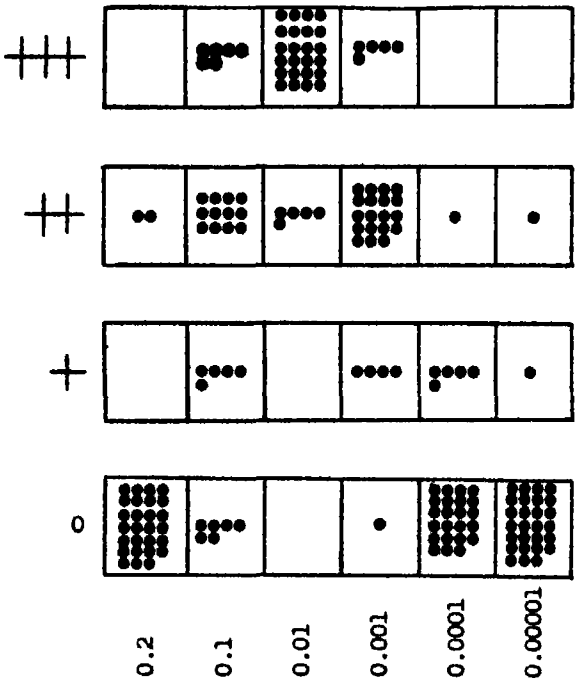
[3] A fat-free water extract. One part equals twenty parts of whole fresh liver.

[4] P. H. Phillips and E. B. Hart, *Jour. Biol. Chem.,* 109: 657, 1935.

[1] M. Bruger, Science, 97: 585, 1943.

In the application of a similar procedure to routine studies, we studied a series of normal individuals, using the proposed fractional test.[3] It was noted that, whereas with 0.2 cc of undiluted blood serum a negative reaction would occur in nearly every instance, a positive reaction was noted when 0.1 cc of saline-diluted serum or less was employed (Fig. 1). This was particularly the case with greater dilutions of serum with saline, so that with 0.01 cc of diluted serum a definitely positive reaction usually occurred.

FLOCCULATION AT VARIOUS DILUTIONS OF SERUM WITH SALINE



Accordingly, it is obvious that the fractional cephalin-cholesterol flocculation test by means of serial saline dilutions of blood serum is not a valid procedure for following alterations in hepatic function.

I. Arthur Mirsky
Ruby von Brecht

Station Hospital,
Miami Beach Training Base, AAFTTC,
Miami Beach, Fla.

A TECHNIQUE FOR DIFFERENTIATING THE CELLS OF THE PITUITARY OF THE RAT

It is well known that procedures worked out for staining human tissues do not always give good results when used on animal tissues. In connection with some work done in this department it was necessary to devise a stain to differentiate the acidophils and basophils of the pituitary of the rat. Mallory connective tissue stain, using the procedure described in Mallory, "Pathological Technique," does not give satisfactory differentiation, but the adaptation here described, using somewhat different dye concentrations, different staining times and a different staining temperature, has given excellent results. The procedure is as follows:

Fixation: Fix in Helly's fluid and imbed in paraffin. Cut sections 4 micra in thickness.

Staining: (Note: Control each step under the microscope; all times given are average).

(1) Stain approximately 5 minutes in a 0.1 per cent. (aqueous) solution of acid fuchsin.

(2) Wash in water, then differentiate 1–2 minutes in water containing 8 drops glacial acetic acid per 100 cc.

(3) Aniline blue stain

Aniline blue (w.s.)	0.5 gm
Orange G	1.3 "
Phosphotungstic acid 1 per cent. (aqueous) solution	100.0 cc

Stain at 35–40 degrees C for 10–15 minutes. Wash off excess stain in water.

(4) Dehydrate quickly in 95 per cent. and absolute alcohols. Clear in xylol, mount in balsam.

Miriam Reed

Department of Biochemistry,
School of Hygiene and Public Health,
The Johns Hopkins University

BOOKS RECEIVED

Bining, Arthur Cecil. *The Rise of American Economic Life.* Illustrated. Pp. xii + 732. Charles Scribner's Sons.

Bishop, Sherman C. *Handbook of Salamanders.* Illustrated. Pp. xiv + 555. Comstock Publishing Company. $5.00.

Breland, Osmond P. *Manual of Comparative Anatomy.* Pp. ix + 250. McGraw-Hill Book Company. $2.00.

Ephraim, Fritz. *A Text-Book of Inorganic Chemistry.* Fourth edition. Illustrated. Pp. xii + 921. Gurney and Jackson. 28 net.

MacBride, J. Francis. Flora of Peru. Pp. ii + 507. Field Museum of Natural History. $3.50.

Wood, Andrew Dick and Thomas Gray Linn. *Plywoods. Their Development, Manufacture and Application.* Illustrated. Pp. xxi + 373. The Chemical Publishing Co. $4.00.

---

[2] F. M. Hanger, *Jour. Clin. Invest.*, 18: 261, 1939.

[3] We are indebted to Dr. David Klein, The Wilson Company, for generous supplies of a standardized Cephalin-Cholesterol mixture.

SCIENCE

VOL. 98 FRIDAY, DECEMBER 10, 1943 No. 2554

The Mexican Volcano Paricutin: DR. PARKER D. TRASK ... 501

Presentation of the Sedgwick Memorial Medal ... 505

Obituary:
Elmer Darwin Ball: DR. CHAS. T. VORHIES. *Deaths and Memorials* ... 506

Scientific Events:
The Proposed Development of Wayne University; Rare Chemicals; The Sugar Research Foundation; The Alabama Academy of Science; Awards of the American Society of Mechanical Engineers ... 508

Scientific Notes and News ... 511

Discussion:
Tryptophan and Phytohormone Precursors: PROFESSOR GEORGE S. AVERY, JR. and DR. JULIUS BERGER. *The Roots of Spinal Nerves:* DR. DONALD DUNCAN. *Taxonomy and Genonomy:* PROFESSOR CARL EPLING. *Isolation of Influenza A by Intra-allantoic Inoculation of Untreated Throat Washings:* MINNIE THIGPEN and JAMES CROWLEY ... 513

Scientific Books:
Naturalist at Large: PROFESSOR T. D. A. COCKERELL. *Developments in Science:* DR. S. A. KORFF 516

Special Articles:
Retardation of Rancidity by Sulfhydryl Compounds: DR. PAUL GYÖRGY, DR. ERIC T. STILLER and DR. MARTIN B. WILLIAMSON. *Vitamin B_6 Deficiency Anemia in the Dog:* SUSAN GOWER SMITH, ROBERT CURRY and HAROLD HAWFIELD ... 518

Scientific Apparatus and Laboratory Methods:
✓*Technique for Stroboscopic Studies of Insect Flight:* DR. CARROLL M. WILLIAMS and DR. LEIGH E. CHADWICK. *The Coagulum-Contact Technic in Traumatic Rupture of the Liver in Dog and Man:* DR. MACHTELD E. SANO and DR. CLARENCE A. HOLLAND ... 522

Science News ... 8

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

THE MEXICAN VOLCANO PARICUTIN[1]

By Dr. PARKER D. TRASK

U. S. GEOLOGICAL SURVEY

THE new volcano in Mexico, El Parícutin (pronounced Pah-*ree*-koo-teen) is a unique geological phenomenon; for, before our very eyes, it has sprung into existence and has grown to a very respectable height of 1,500 feet, all within a period of 8 months. It lies within a region in which no previous volcanic activity has been known within the memory of man, though in 1759 the volcano El Jorullo, some 50 miles to the southeast, likewise suddenly was born, grew to a height of more than 1,000 feet within 5 months, and then quieted down, never more to erupt violently. Will Parícutin do likewise? That remains to be seen, for at present it is still going strong.

For the first time in their lives geologists have been able to observe in a single volcano all stages of its history. Parícutin exhibits many of the features of other volcanoes; but other volcanoes have been encountered by geologists after they have been in existence for some time, and their early history is unknown. The early history of Parícutin therefore fills important gaps in our understanding of volcanism.

To me the most outstanding aspect of this volcano is the incredible rapidity with which it grew. Within one week it was 550 feet high and within 10 weeks it was 1,100 feet in altitude. Up to this time, all the material in its cone had come from fragments that had been blown into the air from the volcano. No lava came from the cone until nearly four months after the eruption started; and then, contrary to some popular reports, it did not flow over the lip of the crater. Instead, it broke through the sides of the cone, undermining the overlying fragmental material. Lava appeared within two days of the first explosion, but it issued quietly from a fissure about 1,000 feet north of the explosive vent.

---

[1] Address presented before the Geologic Section of the New York Academy of Sciences in New York, October 4, 1943. Published by permission of The Director, Geological Survey, U. S. Department of the Interior.

Geologists have been observing Parícutin practically from its inception. Dr. Ezéquiel Ordoñez, the grand old man of Mexican geology, despite some eight decades of age, reached the volcano, together with some associates from the Instituto Geológico de Mexico, within two days of its birth; and he has actively been watching its development ever since. Senor Téodor Flores, director of the Instituto Geológico, has devoted all available facilities of his institution to the study of Parícutin, and the passionate interest he has shown in this volcano would gladden the heart of any scientist.

Dr. William F. Foshag, of the U. S. National Museum, in charge of the war-minerals work of the U. S. Geological Survey in Mexico, has been making a systematic study of Parícutin, and I am indebted to him for practically all statements in this paper not based on my own observations. In addition, many other geologists have visited the volcano. Therefore eventually a rather complete record of its history will be available. I saw Parícutin three times: first, a week after its birth; a second time when it was nearly three months old; and once again, a month later, when I flew over it in an airplane during one of the stages when lava was pouring from the cone.

Parícutin is located in the state of Michoacan, 200 miles in airline due west of Mexico City in the Sierra Madre Occidental, which forms the west boundary of the high plateau that occupies the central part of Mexico. The volcano is situated in an area of forested hills and cultivated lowlands, and the base of the cone lies about 7,500 feet above sea level.

Parícutin is readily accessible. In the early stages an automobile could be driven to the front of the advancing lava flow, but now so much ash has fallen that the only practicable approach is by road to San Juan de Parangaricútiro, where horses are available for visitors to the volcano, four miles distant. San Juan is 15 miles by passable dirt road from Uruapan, which in turn is 300 miles by excellent paved road or by rail from Mexico City. Frequent comfortable bus service is maintained between Mexico City and Uruapan, and the ride is one of the most beautiful in the whole world. Good accommodations are to be had in Uruapan and frequent bus service to San Juan is available. Costs are surprisingly low.

Parícutin is located in a region of volcanic rocks consisting of essentially the same andesitic basalt as its own lava. Several hundred volcanic cones lie within a radius of 75 miles of the volcano. These are of all ages; some are so fresh that they can hardly be more than a few hundred or a few thousand years old; others are so dissected by erosion that they must be many tens of thousands of years in age. Most of them are cinder cones—that is, cones composed of debris blown from a vent in the ground; others are composite cones consisting of both lava and fragmental material. They range in height mainly from 200 to 800 feet. The highest rises some 4,000 feet above the surrounding country. The soil is rich and is derived from volcanic ash and interbedded lava. Most of the cones are conical and have small craters, but a few consist of rings of fragmental material, 200 feet or less in height and some hundreds of feet in diameter. One such abortive cone is situated about one mile northwest of Parícutin; another lies some miles to the east. From the air this latter cone seems to be some 3,000 feet in diameter and less than 200 feet in height. It contains within it, but somewhat off center, a similar ring-like ridge about 1,500 feet in diameter.

The first intimation that something was about to happen was an account in the newspapers about February 12, 1943, that 25 to 30 earthquakes had been felt the previous day near the town of San Juan de Parangaricútiro. Each day thereafter increasingly more tremors were reported, and on February 19 some 300 earthquakes occurred. The next day the eruptions started.

Stories of the beginning of the volcano are legion, and as time goes on they probably will become more varied. One of the most colorful is that a farmer while plowing his field turned over a stone, whereupon lava gushed forth and, like the headless horseman in the Legend of Sleepy Hollow, raced down the furrows behind him as he fled. This story of course is fantastic; in the first place, no Mexican would plow a furrow down hill, and in the second place, the Parícutin lava was too viscous to flow rapidly.

The most reliable story is that a farmer, Dionisio Pulido, while plowing noticed a column of smoke about three inches in diameter spiralling upward from a small hole in the middle of the field. Thinking that he had inadvertently started a fire he went over to the smoke and put it out by placing a stone over the hole. He continued plowing and sometime later looked around and saw smoke emerging from the ground in greater force. He went forthwith to inform the Presidente of the town of San Juan, who sent a group to see what was happening. Upon arriving at the spot three hours later these people found a hole some 30 feet in depth from which dense clouds of dark smoke were issuing. About ten that night, February 20, the first explosion occurred, and since that time the volcano has been erupting steadily.

When I first visited the volcano, on February 28, a little over one week after its inception, the explosions were coming at fairly regular intervals of 4 seconds. At times two explosions would come in quick succession; at other times the interval between outbursts was 6 or 8 seconds. In general the explosions were of about equal force, though occasional loud outbursts occurred. One was strong enough to knock me off balance while walking some 3,000 feet from the crater.

The sound from the explosions seemed to originate within the crater at about the level of the ground, though occasional explosions took place in the ash cloud 500 feet above the top of the cone. Each explosion from the crater acted like a giant gun-burst. The material was ejected from the throat of the volcano in a cylindrical column to a height of 400 to 800 feet above the top of the volcano, and at this point, like water in hydraulic jump, suddenly formed dark expanding cumulus clouds of ash that billowed upward to a height of 6,000 to 8,000 feet above the ground, where steam would begin to condense. With increasing altitude the ash cloud became progressively whiter with water vapor until some 10,000 to 12,000 feet above the ground, where it was nearly pure white. The column of vapor continued upward to about 15,000 feet and was carried eastward in a horizontal cloud bank from which columns or large puffs of vapor curled upward for another 2,000 or 3,000 feet, like ostrich plumes sewed tandem on an ermine scarf.

At this time the material ejected from the crater was thrown upward at an angle deviating from the vertical by 10°, much as if it were coming from a sharply defined conduit. As a result of this inclined direction of outburst, more material fell on the west side of the cone than on the east, thus causing the top of the cone to be lopsided. In the course of four hours the angle of ejection changed gradually back to vertical and two hours later was deviating 5 degrees to the east, thus causing the east side of the cone to build up faster than the west side.

The column of ash ascended nearly vertically but was deflected slightly eastward by the wind. Trains of cinders, one-eighth to one-half inch in diameter, rained down from the ash clouds on the lee side of the cone. They were cool, light and very porous, and they sounded like sleet as they fell on one's hat. Few cinders were falling more than two miles from the volcano. At this distance the ground was just barely covered by them. Fine particles of ash were transported greater distances than cinders, and covered the country side in delicate films for as much as 15 miles away on the leeward side. The ash and cinders were 18 inches thick 500 feet from the edge of the cone, which was the closest to the volcano my courage permitted me to approach.

At this point the ground was pock-marked with pits three to five feet in diameter where large fragments or bombs had buried themselves in the ground. The average distance between bomb-pits at this point was about 20 feet. During some 30 minutes while I was standing there, two bombs fell within 300 feet. One bomb more than four feet in diameter landed 25 feet away. For awhile as it was coming down it looked as though it might make a direct hit, and the problem was which way to run, but eventually it veered slightly and the next moment it came down with a large whoosh and whistle, and buried itself. The top was about one foot beneath the surface of the ground. A piece broken from it was hot enough to light cigarettes. Another bomb two feet in diameter, landed 50 feet to the rear, breaking an oak limb eight inches in diameter, much as if it were a cleaver cutting a bone. This bomb buried itself three feet in the ground. It came down five feet from some girls, who immediately retired to a more discreet distance.

Most of the fragmental material ejected from the volcano in this stage of its history consisted of bombs, rather than of ash or cinders. With each explosion the bombs were blown 2,000 to 3,000 feet into the air. Most of them landed on the cone; the greatest distance at which I found a bomb was 3,500 feet from the center of the volcano. The bombs went so high that it took from 10 to 15 seconds for most of them to fall, after they had reached their greatest height. They were roughly spherical and ranged in size from a walnut to a big house. Most of them were between three and five feet in diameter. The largest I saw was a block 50 feet in diameter, which was blown 300 feet above the top of the crater; that is, 850 feet above the ground. Nearly all the bombs when they landed were so thoroughly solidified as not to change in shape, though many when they struck the sides of the cone, broke into pieces. A few were still liquid when they landed and splattered out like pancakes on the ground. Bombs of this type did not penetrate the earth for more than three inches. Others rotated slowly in the air, gradually thinning in the middle, and before they fell separated into two tear-shaped bodies. Some, after coming to rest on the cone, smoked for a considerable time, certainly for as long as 15 minutes. Most of the bombs consisted of highly vesicular basalt, but a very small proportion were composed of a light medium-grained granitic rock that looked like diorite. These granitic rocks were angular, and not vesicular. They evidently were blown from the conduit through which the lava was coming.

Most of the bombs landed upon the sides of the cone, ricocheting down the side until they came to rest. The sides of the cone were remarkably even and were at an angle of 33° with the horizontal. The volcano at this time was 550 feet high and 1,700 feet in diameter at the base. The diameter of the crater at the top of the cone was 250 feet, and the orifice from which the material was ejected seemingly was about 75 feet in diameter.

The volcano at night is a magnificent, never-to-be-forgotten sight. Nearly all the bombs that are blown from the crater are red hot, and they shower up like a gigantic Fourth-of-July flower-pot. The floral effect is complicated by the fact that four or five subsequent explosions have taken place before the bombs from any one explosion have all landed. Thus some bombs are going up, some are just arching over at their highest point, and others are falling. After the bombs strike the sides of the cone they cascade down in great fiery arcs. Some come to rest on the sides; others roll to the bottom. The glow from the cone comes and goes, depending upon the number of bombs that fall and the interval between explosions. Big outbursts cover the whole volcano, and the cone progressively lightens up in an ever larger descending curtain of fiery red, as the fragments land progressively down the sides of the cone. Then, as the bombs cool, the red gradually darkens. Yet before the color finally vanishes another crop of bombs falls and the scene is repeated. Even though parts of the cone may fade into darkness before a succeeding increment of glowing bombs descends, a ring of red always remains around the edge of the cone where the rocks that roll completely down the sides come to rest.

A flow of lava first appeared in a plowed field about 1,000 feet north of the crater about two days after the birth of the volcano. In five days it had attained a length of 2,000 feet, a width of 600 feet and a thickness of 20 feet at the sides and front. It continued to grow for about 6 weeks until it was about 6,000 feet long, 3,000 feet wide and more than 100 feet high. The front and sides were steeply inclined; the top was nearly flat and consisted of blocks of congealed scraggly aa lava 3 to 15 feet in diameter.

At the time I saw the lava, five days after it first appeared, it was flowing westward down a gently sloping field at a rate of about three feet an hour in front and one foot an hour on the sides. Like a glacier the lava moved most rapidly in direction of greatest slope, and like a glacier it also developed pressure ridges as it flowed. It advanced by pushing large blocks of solidified lava, three to five feet in diameter, off the front and sides. These blocks fell down the edges of the flow, and in turn were covered by other blocks similarly spalled by the advancing lava. Gradually the molten rock inside the flow passed over the fallen blocks and incorporated them within itself, forming a volcanic flow breccia. At all times the surface of the lava was congealed, except for places from which blocks had broken off at the edges of the flow as the lava advanced. These freshly exposed places consisted of red, pasty, dense lava that solidified within a few minutes to hard rock.

Fumaroles came out of vents 6 inches to a foot in diameter and gave off dense clouds of white smoke, which, according to Foshag, is largely ammonium chloride. The ammonium chloride also condenses in a white powder around the orifices of the fumaroles, and in places a fringe of bright-orange iron chloride is also formed. Few poisonous gases seemingly are given off.

When I visited Parícutin the second time, about the middle of May, nearly three months after its birth, it was still erupting at about the same rate, but the explosions were less forceful and a much larger proportion of ash was coming out. The cone had doubled in height and the orifice from which the material was being ejected seemed to be about 150 feet in diameter. Ash was everywhere, and most of the trees within 5 miles of the volcano had been killed. The lava flow had stopped moving and was covered by 6 to 8 feet of ash. Even at Uruapan, 15 miles east of the volcano, the ash was 6 to 8 inches thick, and at San Juan, four miles to the west, it was 15 inches thick. A large part of this ash fell in one period of 36 hours early in April. Electrical discharges or lightning strokes were flashing at irregular intervals, sometimes as frequently as 30 an hour. These flashes were vertical in the cloud of ash, and generally started within a few hundred feet of the top of the cone. They ranged in length mainly from 500 to 1,500 feet, and produced sharp cracks but no loud thunder.

About four weeks after this visit, a phase of lava actively ensued. In the course of a week, 8 flows appeared, all from within the cone. Prior to this time, that is, for almost four months, no lava had come from the cone itself and there had been just the one flow. According to Foshag, each flow was preceded by a period of violent explosive activity, which terminated shortly before the lava came. While the lava was issuing from the volcano relatively few explosions took place. All these flows ruptured the sides of the cone, and those that came from the upper part of the volcano undermined the fragmental material above, leaving a large gap in the side of the cone. These gaps were rapidly filled by material blown from the crater after the lava ceased to move. One flow advanced in three days as far as the town of Parícutin, three miles to the west. When it approached Parícutin it was moving at a rate of about 100 feet an hour. Another flow on the east side of the cone spread out like a large fan at the base of the volcano. According to Foshag, this one went 1,500 feet in 15 minutes.

While one of these flows was in progress, I had the good fortune to fly over the volcano. At this time the crater was nearly full; lava extending to within 50 feet of the lip. The top of the lava in the crater was congealed, and was broken in large blocks. Ashes were issuing from a vent estimated to be 75 to 100 feet in diameter in the northwest part of the lava field within the crater, but relatively few explosions were seen. Lava was flowing from an opening on the east side of the cone. This vent was 50 to 75 feet in width and 200 to 300 feet in height. The upper limit was 100 to 150 feet beneath the lip of the crater. The lava coming through the opening was red hot, but it soon cooled and congealed while flowing down the sides of the volcano. The cone was intact above the point of escape of lava, but according to Foshag it subsequently was undermined by the flow.

At this time, June 19th, Parícutin was 1,200 feet in altitude. By late September it had reached a height of 1,500 feet. At that time it was still exploding at about the same rate as when it started, and was showing no signs of dying. In the meantime several other flows of lava had appeared, mostly from within the cone. Parícutin truly is now a full-fledged volcano.

PRESENTATION OF THE SEDGWICK MEMORIAL MEDAL

THE Sedgwick Memorial Medal of the American Public Health Association was presented at the seventy-second annual meeting on October 12 to Brigadier General James Stevens Simmons, U. S. A., director of the Preventive Medicine Division of the Office of the Surgeon General, U. S. Army.

The medal was established in memory of William T. Sedgwick, of the Massachusetts Institute of Technology, pioneer teacher of public health in the United States. It is awarded for distinguished service in public health. The following have received the award in the past:

1929	Charles V. Chapin
1930	Theobald Smith
1931	George W. McCoy
1932	William H. Park
1933	Milton J. Rosenau
1934	Edwin O. Jordan
1935	Haven Emerson
1936	Frederick F. Russell
1938	Wade H. Frost
1939	Thomas Parran
1940	Hans Zinsser
1941	Charles Armstrong
1942	C.-E. A. Winslow

Dr. C.-E. A. Winslow, of the School of Medicine of Yale University, made the presentation address, which was followed by an address of acceptance by Brigadier General Simmons.

PRESENTATION ADDRESS OF DR. C.-E. A. WINSLOW

SHORTLY after the close of the first World War a distinguished British orthopedist was presented for an honorary degree at Yale with the statement that "no man has contributed more than he to the upright position of Britain during the recent war." The Sedgwick Medal is this year awarded for somewhat similar reasons. The 1943 recipient of this medal has done more than any other single individual to make the science of public health effective in maintaining the manpower which our nation has mobilized for the defense of freedom.

James Stevens Simmons was born at Newton, N. C., in 1890. He took his M.D. at Pennsylvania in 1915 and in 1916 entered the Medical Corps as a first lieutenant. For more than a quarter of a century he has devoted his life to the upbuilding of public health laboratory service in the military establishment. In an Overseas Unit in 1918, at the Walter Reed Hospital, in Honolulu and Manila, on the Canal Zone and in the Army Medical School he contributed materially to sound laboratory practice and in 1935 edited a valuable volume on "Laboratory Methods of the U. S. Army." He has made significant original contributions to our knowledge of malaria, and encephalomyelitis and other insect-borne and virus diseases.

With the outbreak of the present war, Colonel Simmons (now Brigadier General Simmons) was entrusted with the organization of a Division of Preventive Medicine in the Office of the Surgeon General. To his energy and vision, to the inspiration of his open and generous and affectionate personality, goes the chief credit for an astounding record of creative initiative and administrative efficiency. The creation of a Board for the Investigation and Control of Influenza and other Epidemic Diseases in the Army (including the most eminent experts in all related fields); the appointment of a distinguished headquarters staff; and the despatch of highly qualified commissions to points of danger all over the world—these have been the instruments in planning a health program of global extent with a record of phenomenal achievement. Operating in some of the most deadly swamps of the world, in regions where malaria and typhus fever and dysentery have for centuries reigned supreme, our army has functioned with a relative freedom from disease unprecedented in military history. At home, the success with which venereal infections have been held in check is equally notable; and, so far, the Army has suffered no serious disability from any of the upper respiratory diseases.

The record to date has constituted one of the finest chapters of achievement in the whole glorious century of modern public health. We do well to honor General Simmons as the central inspiration of this achievement; and in honoring him we pay tribute to the Army of the United States, which has proved itself as efficient by the bedside and in the laboratory as on the beach-heads of the Pacific and the Mediterranean.

Professor Sedgwick, in whose memory this medal is awarded, devoted his life to the application of science in the service of the state. He would hail this outstanding example of such application. One of his last major addresses was delivered during the first World War under the title "From Peace to War, from War to Victory, from Victory to Just Judgment." He would exult that public health science has, through General Simmons, made so important a contribution to the completion of the task which we left unfinished twenty-five years ago, but which we now propose to push on to completion.

ADDRESS OF ACCEPTANCE OF BRIGADIER GENERAL JAMES STEVENS SIMMONS

Mr. President, Dr. Winslow, fellow Members of the American Public Health Association, Ladies and Gentlemen:

I appreciate deeply the great honor which you have shown me and the Medical Department of the Army, by this public expression of your approval of our efforts in the fields of military preventive medicine.

Your gracious invitation to attend this meeting and receive the Sedgwick Memorial Medal, reached me by radio a few weeks ago at our military headquarters in New Delhi, where I had arrived after surveying the Army's health activities in the European, North African and Middle East Theaters. Naturally it came as a welcome surprise. As I flew back over the long air highways to join you, I experienced a feeling of deep satisfaction and humble appreciation. My pleasure was in part personal, but I was even more pleased with your recognition of the medical department's achievements in the prevention of disease.

The far-flung forces of the U. S. Army are now scattered throughout many parts of the world where they are exposed to a great variety of crippling diseases. In some of these areas—especially in combat zones, the incidence of certain infections has at times been a matter of concern, but considered as a whole the health of our troops has been remarkably good. In fact, during this war the incidence rates for many serious diseases in the Army have been lower than at any time since the battle of Lexington.

This remarkable triumph in military preventive medicine can not be ascribed to any single person or organization. It has resulted from the combined effort of all the health agencies of the nation functioning as a finely coordinated, efficient team, united for war. The Surgeon General of the Army has been responsible for the establishment of an effective health program, and the officers of the Medical Department have carried it out. However, at every step in the development and execution of this program the Army has received and utilized the advice and assistance of the entire public health profession of the United States.

Advantage has been taken of the existing large fund of information concerning the control of disease; and, when indicated, studies designed to improve old control methods or to develop new ones have been undertaken. The U. S. Public Health Service working through state and other health agencies, has carried out an enormous program of extra-military sanitation and disease control in order to protect troops from infectious diseases occurring in the civil population. The National Research Council, the Committee on Medical Research, the Department of Agriculture and other governmental agencies have contributed materially to the Army's health program. Innumerable civilian agencies and scientific organizations, particularly the American Public Health Association, have played an active role in furnishing a host of scientific advisers and investigators who have helped the Army in the solution of its many health problems.

I regret that I did not have the privilege of knowing Dr. Sedgwick and of working with him. I am sure that it is the deep regret of all who are assembled here that he is no longer with us in person. However, we have a keen sense of his being here in spirit and believe that he must take profound satisfaction in knowing that many of the advances which have been made in the prevention of disease in the Army are due to his vision and influence. These achievements are the outcome of the development of basic principles established by this great pioneer in public health and preventive medicine.

Again I wish to thank you for selecting me to receive the Sedgwick Medal. I am delighted to accept it with the full realization that in so doing I am only acting as its custodian for the Medical Department of the Army and for the health workers of the United States.

OBITUARY

ELMER DARWIN BALL

On October 5, 1943, in Pasadena, California, there passed from life a well-known scientist and administrator, whose scientific career had been brought to an abrupt termination more than five years earlier, when Dr. E. D. Ball, in February, 1938, suffered a cerebral hemorrhage at his home in Tucson, Ariz. Since then he had been on extended leave from the University of

Arizona, where he was professor of zoology and entomologist of the Agricultural Experiment Station.

Elmer Darwin Ball was born in Athens, Vt., on September 21, 1870, the son of Leroy A. and Mary A. (Mansfield) Ball. The family removed soon after to Iowa, with which state Dr. Ball was identified during his early life and the beginning of his career. In 1899 he married Mildred R. Norvell, who survives him.

In the public schools of Iowa and Iowa State College he received his early education and teaching experience, receiving the B.S. and M.S. degrees from the college in 1895 and 1898. After teaching in the common schools of his state and serving a year as assistant principal of Albion Seminary, he began his scientific teaching career as assistant in zoology and entomology at his alma mater, transferring from there to a similar position in the Colorado Agricultural College in 1897 for four years. Next he accepted a professorship in the Utah Agricultural College and completed, during this period of his career, his graduate work under guidance of Professor Herbert Osborn, becoming a specialist in the leafhoppers and related families and receiving the Ph.D. degree from Ohio State in 1907. He has been for years an outstanding authority on the taxonomy of these groups of insects.

In 1907 also he was appointed to be dean of the Utah Agricultural College and director of the Experiment Station, and it was while he served in this capacity that the writer first met him and formed a friendship of many years standing. He could always be counted upon for support of local scientific organizations, as well as national, as evidenced by his holding membership in the Academies of Science of Iowa, Ohio, Utah, Wisconsin, California and Washington, D. C., in addition to the usual memberships in professional organizations.

In 1916 Dr. Ball became state entomologist of Wisconsin, but after two years returned to teaching as head of the department of zoology and entomology at Iowa State College. Since this position entails also the duties of state entomologist, teaching may have been largely curtailed by administration. The last two years of his incumbency at Iowa State he was on leave to serve as assistant secretary of agriculture under secretaries Meredith and Wallace. From 1921 to 1925 he was director of scientific work in the U. S. Department of Agriculture. Here he backed legislation raising salaries of scientific workers in the department to enable it to obtain and hold better research men.

From 1925 to 1928 Dr. Ball was in charge of celery insect investigations for the Florida State Plant Board. The resulting publication by Ball and coworkers is outstanding in its emphasis on the ecological phases of the problem, and shows in fact that the celery leaf tier is effectively prevented by ecological conditions from doing damage most years and that artificial control is only occasionally necessary and can be anticipated in time to prepare.

In the fall of 1928 he became dean of the College of Agriculture and director of the Agricultural Experiment Station of the University of Arizona, and in 1931 transferred again to teaching and research in the position held at the time illness overcame him.

Dr. Ball throughout his career was known as an indefatigable investigator. In Utah he pioneered in development of the driving spray method of codling moth control, did the genetics work on a long-time poultry breeding experiment, and first clearly recognized and pointed out the probable transmission of curly top of sugar beets by the beet leafhopper, later proven, and now unquestioned. The third discovered instance of insect transmission of plant disease, tipburn of potato, was first suggested by him. While in the Wisconsin work, he suggested and organized methods of eradication of American foul brood of bees and in Arizona engaged in a major project on range grasshoppers.

Throughout his career he used every possible hour and vacation period in collecting and taxonomic study of those small but often economically important little insects known as leaf-hoppers, tree-hoppers, froghoppers and some related forms. His unrivalled private collection of these insects is now a part of the National Museum collection. His contributions number some two hundred papers, of which over one hundred are taxonomic, more than sixty economic, and the remainder in general science and administration.

Dr. Ball was an enthusiastic teacher, helpful with counsel and financial assistance to worthy students. The writer has known him as a colleague in scientific organizations, as a dean and director, and finally as a member of the writer's department and in all these capacities as a cheerful co-worker and loyal friend.

Chas. T. Vorhies

DEATHS AND MEMORIALS

Dr. Malcolm D. Brode, professor of zoology at the University of South Carolina from 1927 to 1929 and at Beloit College from 1929 to 1935, lost his life on November 1 in a fire at Berkeley, Calif. He was forty-three years old.

Lieutenant Charles F. Bowers, on leave as professor of architectural engineering at Iowa State College, is reported to have lost his life on October 21 in an airplane accident in the South Pacific.

Professor Rolland D. Fox, associate professor of bacteriology at the University of Akron and director of the laboratories of the health department of the city of Akron, died on October 24 at the age of forty-four years.

DR. ARMIN V. ST. GEORGE, associate professor of pathology at the New York University School of Forensic Medicine and since 1916 assistant director of the laboratories at Bellevue Hospital, died on November 20. He was fifty-one years old.

EARLE R. PICKETT, since 1929 chief chemist for the Beech-Nut Packing Company, died on November 6 at the age of forty-seven years.

RALPH N. MAXSON, for thirty-seven years a member of the department of chemistry of the University of Kentucky, died on November 18. A correspondent writes: "His first diploma was granted him at Rhode Island State College in 1902. He received his Ph.D. from Yale University in 1905 and became affiliated with the University of Kentucky in 1906. In 1907 he was made assistant professor; in 1909 professor of inorganic chemistry. He became head of the department of chemistry in 1934, but in 1942 he resigned that position and resumed his former title of professor of inorganic chemistry, a position he held until his death. Dr. Maxson was a member of the American Chemical Society since 1910, the American Association of University Professors, the Society of Sigma Xi and Pi Gamma Mu, and the Kentucky Educational Association."

THE REVEREND FATHER GILLET, director of the Botanical Garden of Kisantu, Inkisi, Belgian Congo, Africa, died on July 22. He is succeeded by his assistant, the Reverend F. L. Gorissen.

THE death at the age of sixty-three years is announced from Moscow of Dr. Sergeo I. Spasokukotey, the well-known surgeon, a member of the Academy of Sciences of the USRR, who a short time ago received the Joseph Stalin Award.

Nature reports the death of Dr. H. L. Lebesque, For. Mem. R.S., during 1941 professor of mathematics in the Collège de France, at the age of sixty-eight years, and of Professor Einar Lönnberg, the well-known Swedish zoologist.

IT is reported in the *Journal* of the American Medical Association that a bas-relief portrait of Dr. James B. Herrick, for many years a member of the staff of Presbyterian Hospital, was presented to the hospital during special exercises on November 6 commemorating the sixtieth anniversary of the hospital, the fortieth anniversary of the founding of the School of Nursing and the one hundredth anniversary of the admission of the first students to Rush Medical College. The portrait was presented on behalf of the associates of Dr. Herrick by Dr. Ernest E. Irons, formerly dean of the college.

THE *S. S. Victor C. Vaughan*, launched at Portland, Oregon, on September 12, was named in honor of the late Dr. Vaughan, dean of the Medical School of the University of Michigan. The name Victor C. Vaughan was given on Federal order. Dr. Vaughan was one of several distinguished American men of medicine named by a special commission delegated to select the men to be so honored. *The Michigan Alumnus*, in the issue of October 23, records the naming of the Vaughan General Hospital, a new unit of the Army's system of hospitals.

A LIBERTY ship named in honor of Charles H. Herty, formerly editor of *Industrial and Engineering Chemistry* and in 1915–1916 president of the American Chemical Society, was recently launched.

THE Spanish Cultural Institute at Buenos Aires has dedicated a histological laboratory to the memory of Ramon y Cajal. It is under the direction of Professor Hortegan.

SCIENTIFIC EVENTS

THE PROPOSED DEVELOPMENT OF WAYNE UNIVERSITY

CITIZENS of Detroit and Wayne County have formed a corporation for the construction of the first units of the projected $50,000,000 Medical Science Center of Wayne University.

The announcement was made by Wendell Anderson, chairman of the Citizens' Executive Committee, which has had the project in charge since the Board of Education adopted a resolution pointing out that the program of the Medical Center had "progressed to a point requiring more formal organization." The resolution went on to request the incorporation.

The corporation will be called "The Medical Science Center of Wayne University." Its first board of directors, as designated in the resolution, will be Wendell Anderson, Dr. Warren E. Bow, George R. Fink, Charles T. Fisher, Jr., Frederick J. Gartner, Elmer P. Grierson, Ormond E. Hunt, E. Edwin Hutchinson, George W. Mason, Henry Meyers, Dr. Edgar H. Norris, Dr. Burt R. Shurly and Fred M. Zeder.

The corporation will have full charge of planning, developing and equipping the Medical Science Center, and will raise money for these purposes. When completed, individual units will be turned over to Wayne University, which will then own and operate them.

The Board of Education has approved a site for the first unit. Three blocks are to be used as a site for the Wayne University-County Hospital. Construction of the hospital should begin within a year. In addition to the three blocks to be acquired immediately, the board recommended that the adjacent district with a gross area of 53 acres, be earmarked for the future development of the center. The entire site has the recommendation of the City Plan Commission, the trustees of the Wayne University-County Hospital, the board of directors of the new Medical Science Center Corporation, and the administrative officers of the university.

Tentative plans for a new historical and industrial museum were shown to representatives of Michigan historical organizations at a meeting held on November 19. The plans were drawn up by William E. Kapp, president of the Detroit Chapter of the American Institute of Architects. Speakers at the meeting included L. Hubbard Shattuck, director of the Chicago Historical Society, and Dr. David D. Henry, executive vice-president of Wayne University. George W. Stark, president of the Detroit Historical Society, announced that Mrs. Charles B. Pike, of Chicago, had given to the society the sum of $50,000 to assist in financing an auditorium in memory of her father, General Russell A. Alger, to be known as the General Russell A. Alger Military Memorial Hall. The auditorium will form a part of the proposed museum. A condition of the gift provides that, within eighteen months of the signing of the trust agreement, an additional $200,000 must be raised to further the project.

RARE CHEMICALS

THE following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

1-Amino-4(4-aminophenylamino) anthraquinone
Bituminous Shale Oil
Cytosine
Beta hydroxy glutamic acid-d
Methyl isopropenyl ketone
Morin (pure)
Neopentane (pure)
Potassium salt of tetrabromphenolphthalein ethyl ester
Titanium hydride
Silver fluoride
beta-amyrin
Tetra butyl lead
Triphenyl lead hydroxide
Tritolyl lead hydroxide
Tributyl lead oleate
Tributyl lead ricinoleate
Tetraphenyl tin
Tetra butyl tin
Triphenyl tin hydroxide

THE SUGAR RESEARCH FOUNDATION

A LONG-RANGE program of research on sugar will be undertaken at the Massachusetts Institute of Technology in cooperation with the newly established Sugar Research Foundation of New York, which has made a grant of $125,000 for a five-year program of research. Plans for the project were made public in a joint announcement by President Karl T. Compton, of the Massachusetts Institute of Technology, and Joseph F. Abbott, president of the Sugar Research Foundation.

The foundation was established for the development of fundamental knowledge in the field of carbohydrate chemistry, biochemistry and nutrition. Membership is open to all producers and processors of sugar in the United States, Puerto Rico, Hawaii and Cuba.

Dr. Compton, in announcing the cooperative arrangement, said:

> The new program is another step in the institute's long-established policy of cooperation with industry in fundamental research to improve industrial processes and develop new products. The project we are about to undertake is a pioneering plan of national significance in that it promises substantial benefits, not for one organization, but for an entire industry.
>
> The rewards of scientific research in cooperation with industry are by no means restricted to the development of new products, for the discovery of new knowledge in any branch of science invariably proves to be a contribution to advanced technical education in associated fields. Thus this sponsored research on sugar makes it possible for the institute to continue and expand the program of fundamental investigations in the field of carbohydrate chemistry which has been in progress for several years.
>
> We are particularly glad that Dr. Robert C. Hockett, who has been given leave of absence from our faculty to become the scientific director of the Sugar Research Foundation, will be in charge of this broad program.
>
> The sugar industry is to be commended for its public service and vision for making possible this objective research. I feel sure it will be rewarded by results of great scientific value to the public.

Commenting on the new laboratory, Joseph F. Abbott, president of the Sugar Research Foundation, said in part:

> It is anticipated that the chemical studies conducted under the arrangement with the Massachusetts Institute of Technology will not only extend knowledge of the role of sugar and other carbohydrates in the human body, but also will unfold wholly new industrial uses for sugar and its derivatives. It is our hope that the collaboration between the industry and this outstanding technical institution will prove to be of great benefit to science and the general public as well as to the industry.
>
> An important objective of this broad research program will be the training of scientists in the field of carbohydrate chemistry to prepare them for service in the industry for further technical studies. Provision has also been

made for fellowships for young graduate students who are candidates for advanced degrees to permit them to continue their work in this field.

THE ALABAMA ACADEMY OF SCIENCE

The new officers for the Alabama Academy of Science for 1943–44 are: *President,* Dr. E. V. Jones, Birmingham-Southern College; *President-Elect,* Dr. James T. MacKenzie, American Cast Iron and Pipe Company; *Secretary,* Winnie McGlamery, Alabama Geological Survey, University; *Councilor of the American Association for the Advancement of Science,* Dr. Septima C. Smith, University; *Councilors of Junior Academy,* Dr. Alvin V. Beatty, University; Miss Kathryn M. Boehmer, Birmingham; *Section Chairmen:* Biology and Medicine, Dr. J. M. Robinson, Alabama Polytechnic Institute; Chemistry, W. C. Frishe, Alabama Polytechnic Institute; Geology and Anthropology, Peter A. Brannon, Department of Archives and History, Montgomery; Geography and Conservation, Miss Lillian Worley, Alabama College, Montevallo; Physics and Mathematics, Dr. G. F. Barnes, Judson College, Marion; Industry and Economics, Roy Goslin, Alabama Polytechnic Institute; the Teaching of Science, Dr. J. L. Kassner, University.

The Alabama Academy of Science did not hold the usual spring meeting in 1943, which was scheduled at Auburn. Instead there was a called meeting of the executive committee during the latter part of April in Birmingham, at which time it was decided that the 1944 spring meeting of the academy would be held in Birmingham, the date to be determined later.

Winnie McGlamery,
Secretary

AWARDS OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The American Society of Mechanical Engineers conferred its 1943 honors and awards at the dinner program of its sixty-fourth annual meeting at the Hotel Pennsylvania on December 1. Harold V. Coes, retiring president of the society, and Ralph S. Damon, general manager of American Airlines, Inc., were the speakers.

The medal of the society was awarded to Lewis K. Sillcox, a fellow of the society, first vice-president of the New York Airbrake Company and vice-president of Hydraulic Controls, Inc., Chicago. Established in 1920, the medal is given for "distinguished service in engineering and science." The citation accompanying the award reads in part: "Eminent engineer executive, distinguished lecturer . . . a lover of wisdom . . . for his preeminent and permanent contribution to the art and science of engineering, of transportation, of education and the fine art of living."

Dr. Vannevar Bush, president of the Carnegie Institution of Washington, D. C., and director of the Office of Scientific Research and Development, was awarded the Holley Medal as "engineering educator, inventor and leader in scientific research," for "machines used in easing applied mathematics from computational barriers." This medal, instituted and endowed in 1924 by George I. Rockwood, past president of the society, is given for engineering genius that has accomplished "a great and timely public benefit." Dr. Bush is the builder of the differential analyzer, a machine for solving differential equations.

Igor I. Sikorsky, of Vought-Sikorsky Aircraft, Stratford, Conn., a fellow of the society, inventor of the helicopter and the Sikorsky multi-motored amphibian, received the Worcester Reed Warner Medal, given for a paper dealing with progressive ideas in mechanical engineering or efficiency in management. The medal was awarded "for his stimulation of the engineer in those priceless attributes, imagination and creative ability" and for his inspiration to young engineers engaged in research and development.

Three awards were made which are presented jointly with other societies:

Dr. Charles F. Kettering, of Detroit, general manager of the Research Laboratories Division of General Motors, president of C. F. Kettering, Inc., and vice-president of General Motors, was presented with the John Fritz Medal for 1944. The citation reads: "For notable achievements in the field of industrial research which have contributed greatly to the welfare of mankind and of the nations." In addition to the John Fritz Medal, the American Society of Mechanical Engineers Medal for 1940, which had never been formally conferred, was given to him for "outstanding invention and research."

The Alfred Noble Prize, a cash award given jointly by the American Society of Mechanical Engineers and four other engineering societies, was presented to Dr. Benjamin J. Lazan, of Greenwich, Conn., chief engineer of the Sonntag Scientific Corporation, for his monograph: "Some Mechanical Properties of Plastics and Metals under Sustained Vibration."

Dexter Simpson Kimball, dean emeritus of the College of Engineering of Cornell University, was awarded the Henry Laurence Gantt Memorial Gold Medal for "outstanding attainment in the teaching and practice of industrial management and for distinguished contributions to its literature." He is a fellow, honorary member and past president of the American Society of Mechanical Engineers and a Warner Medalist. This award is presented jointly with the American Management Association.

SCIENTIFIC NOTES AND NEWS

Dr. H. H. Bennett, chief of the Soil Conservation Service, and Dr. Robert V. Allison, of the Florida Experiment Station, will receive from the President of Cuba at the 1944 meeting of the Cuban National Congress of Soil and Fertilizers the Carlos Manuel de Cestenes decoration in recognition of soil studies and investigations made in Cuba from 1924 to 1926.

The council of the Royal Meteorological Society, London, has awarded the Symons Gold Medal for 1944 to Dr. C. W. B. Normand, director-general of observatories in India. The medal is awarded biennially for distinguished work in connection with meteorological science.

Professor Basil F. J. Schonland, F.R.S., director of the Bernard Price Institute of Geophysics and Carnegie-Price professor of geophysics in the University of Witwatersrand, Johannesburg, has been awarded the South African Medal and Grant for 1943 by the council of the South African Association for the Advancement of Science. At present, Professor Schonland is on service as a brigadier in the Union Defence Force, seconded for specialized scientific work with the military authorities in England.

Dr. Lloyd M. Pidgeon, of the National Research Council of Canada, has been awarded the platinum medal of the International Nickel Company by the Canadian Institute of Mining and Metallurgy and the special merit medal of the Professional Institute of the Civil Service of Canada for his development of a process for the production of magnesium. Dr. Pidgeon was recently appointed head of the department of metallurgical engineering of the University of Toronto.

Dr. Cecil J. Watson, head of the department of medicine of the University of Minnesota, has been elected president of the Central Society for Clinical Research.

At the meeting of the Eastern Pennsylvania Chapter of the Society of American Bacteriologists on November 23 the following officers were elected for the year 1944: *President*, Dr. Earl W. Spaulding, department of bacteriology of the School of Medicine of Temple University; *Secretary-Treasurer and Councilor*, Dr. Harry E. Morton, department of bacteriology of the School of Medicine of the University of Pennsylvania; *Councilor's Alternate*, Dr. Ruth E. Miller, of the department of bacteriology of the Woman's Medical College of Pennsylvania.

Harold N. Bixler, personnel director of the Mutual Life Insurance Company of New York, has been elected chairman of the American Society of Safety Engineers.

Dr. R. K. Stratford, chief chemist of the Imperial Oil Company, has been elected president of the Canadian Institute of Chemistry.

Officers of the Royal Society of Edinburgh have been elected as follows: *President*, Professor E. T. Whittaker; *Vice-Presidents*, Dr. James Watt, Professor T. H. Milroy, Sir John Boyd Orr, Dr. A. W. Greenwood, Professor E. Hindle and Dr. D. Russell; *General Secretary*, Professor James P. Kendall.

Lieutenant-Colonel W. B. R. King, Yates-Goldsmid professor of geology at University College, London, from 1912 to 1920 a member of the Geological Survey of Great Britain, has been appointed Woodwardian professor of geology at the University of Cambridge.

Professor H. Gordon Jackson, who has been head of the department of zoology of Birkbeck College, London, since 1921 and professor since 1928, has been appointed head of the college.

Dr. Clifford B. Purvis has succeeded Professor Harold Hibbert as Eddy professor of industrial and cellulose chemistry at McGill University. Professor Hibbert had reached the retiring age.

G. H. Rawcliffe has been appointed to the chair of electrical engineering in the University of Bristol in succession to the late Professor D. Robertson.

Dr. George B. Darling, president and comptroller of the W. K. Kellogg Foundation, has resigned to become associated with the division of medical science of the National Research Council.

Dr. Donald H. Jacobs, associate physicist at the National Bureau of Standards, has been appointed senior physicist at the U. S. Naval Observatory, Washington, D. C.

H. Arthur Meyer, assistant professor of forestry at Pennsylvania State College, has leave of absence to enable him to accept an assignment for cinchona procurement for the Office of Economic Warfare.

Recent appointments to the staff of the biological division of Food Research Laboratories, Inc., Long Island City, New York, include Dr. Nathan Rakieten, formerly of the Laboratory of Applied Physiology of Yale University and lately first lieutenant, U. S. Army Air Corps, and Dr. Roslyn T. Roth, formerly research microanalyst at New York University and more recently biochemist at the New York Psychiatric Institute, Columbia Medical Center. Dr. Rakieten will supervise the animal laboratories; Dr. Roth will specialize in the statistical aspects of the design and interpretation of bioassays.

Sir George Thompson, professor of physics at the Imperial College of Science and Technology, London, has been appointed scientific adviser to the British Air Ministry.

Nature writes that "scientific men and many others will learn with much pleasure that Professor Niels Bohr, of the Institute of Theoretical Physics, Copenhagen, has succeeded in escaping from Denmark and has reached Great Britain."

Dr. William McDowell Hammon, assistant professor of epidemiology at the Medical School in San Francisco of the University of California, and Dr. H. G. Johnstone, assistant professor of bacteriology, are studying tropical medicine in Central America through the cooperation of the Office of Inter-American Affairs and of the Surgeon-General of the Army.

Nature reports that Professor A. V. Hill, secretary of the Royal Society, will visit India to advise on problems of scientific and industrial research in relation to reconstruction problems and the coordination of such research in India with that elsewhere. His tour is being undertaken at the invitation of the Government of India and with the consent of the Royal Society.

Dr. J. Howard Mueller, professor of bacteriology and immunology at the Harvard Medical School, will deliver on December 16 the third Harvey Society lecture of the current series at the New York Academy of Medicine. He will speak on "Nutrition of the Single Cell; its Applications in Medical Bacteriology."

Dr. Frank B. Jewett, vice-president of the American Telephone and Telegraph Company, president of the National Academy of Sciences, spoke on December 1 on new scientific and technological developments and their application to postwar economy at an open-forum meeting of the Institute on Postwar Reconstruction of New York University.

Dr. George L. Clark, professor of chemistry of the University of Illinois, on November 19 addressed the University of Cincinnati Chapter of Sigma Xi on "The Role of the Electron Microscope in Physical, Chemical, Industrial and Biological Research."

Dr. F. C. Bartlett, professor of experimental psychology in the University of Cambridge, gave on November 23 the Huxley lecture of the Royal Anthropological Institute, London. He spoke on "Anthropology in Reconstruction."

The November and December program of lectures arranged by the Royal Institution, London, include a lecture by Sir Joseph Barcroft, F.R.S., on the preservation of foods by drying, and by Professor H. W. Florey, F.R.S., on the development of penicillin for medical uses; a course of lectures will be given on the progress in the treatment of infections by Sir Henry Dale, P.R.S., and a course by Professor J. C. Drummond on the food problems of the post-war years.

The annual meeting of the Society of Automotive Engineers will be held at Detroit from January 10 to 14.

In response to a request made by the second Conference on X-ray Analysis held in Cambridge last April, the Board of the British Institute of Physics has authorized the formation of an additional group empowered to arrange meetings and conferences and generally to be a medium for the exchange of information on matters relating to x-ray diffraction. The organizing committee of the conference, which was requested to act as the first group committee, has elected Professor Sir Lawrence Bragg as chairman and Dr. H. Lipson as honorary secretary and treasurer.

The Associated Defense Committees of Chicago Technical Societies have issued an urgent request for the names and addresses of all engineers or scientists who have technical information concerning industries, communications, transportation, raw materials, etc., of any areas in Europe or in the Pacific which are now held by the enemy or might conceivably become theaters of war operations. The committee is also looking for still pictures or moving pictures showing coastlines, harbors, industrial centers, and the like, of such areas. Those having such information or knowing of some one who has such information should communicate at once with Robert C. Brown, Jr., chairman of the Associated Defense Committees, 226 West Jackson Boulevard, Chicago, giving as much detail as possible concerning the type of information that is available.

Chemical and Engineering News reports that the National Department of Health Service of Mexico City has sent fifteen representatives to study for two terms in the School of Public Health at the University of Michigan. Included in the group are four public health nurses, five public health engineers and six veterinarians. Expenses are paid by the W. K. Kellogg Foundation.

The faculty and administrative officers of the Philadelphia College of Pharmacy and Science have gone on record as being definitely opposed to further acceleration of courses beyond the current war-time plan of conducting the usual four-year course in two years and nine months. Following is a resolution unanimously passed at a meeting of the faculty:

> Whereas: Any lowering of the standards of pharmaceutical education means the inevitable defeat of the effort

to keep pharmacy in the status of a profession, therefore be it

Resolved: By the Faculty of the Philadelphia College of Pharmacy and Science, that we deprecate any movement to shorten the time devoted to the course of pharmaceutical education in the college, and be it further

Resolved: That we request the Board of Trustees of the college to return, as soon as practicable, to the previous requirement of four calendar years of study as a requisite for the degree of bachelor of science in pharmacy, and be it further

Resolved: That a copy of these resolutions be properly publicized to the end that it may be realized that the Philadelphia College stands to-day, as it has in the past, for sound educational principles.

The board of trustees and the dean of the Texas Dental College at Houston announced recently that the program of dental education conducted by the college would be discontinued on August 31 and that the properties of the college would be given to the University of Texas. The school of dentistry was opened on September 1 in the properties acquired by gift from the Texas Dental College, which was founded in Houston in February, 1905. It was organized as a public trust in 1929. Dr. F. C. Elliott has been dean of the college since 1932 and has been named dean of the School of Dentistry of the University of Texas. The Chamber of Commerce of Houston gave a testimonial dinner for Dr. Elliott on June 3 at which he was highly praised for his part in the transfer of the college to the university and for his many public services to the city of Houston and to the State of Texas in the promotion of public health.

After establishing life trust funds of $200,000, the will of the late former Governor Horace White provides that three fourths of the residuary estate shall go to Cornell University at Ithaca and one fourth to Syracuse University. Income from the fund at Cornell University will be applied in whole or in part "to pay or increase salaries of officers and members of the faculty who have rendered distinguished services or who may be of great value to the university." Syracuse University's share in the estate will be known as "the Horace White Fund" and the income will be used to pay the salary of "the Edward C. Reifenstein professorship of medicine." The $200,000 set up for life trusts ultimately will revert to the two universities in their proportionate shares.

It is announced by the Mining Association of Great Britain that the colliery owners of Great Britain will provide further sums, of the order of half a million pounds, for coal research, in order to extend their existing program, which itself involves the expenditure of £1,000,000 over the current five years. The new program relates to the development of processes for producing hydro-carbons and hydro-carbon derivatives from coal and to the treatment of coal generally as a chemical raw material. The program will begin immediately, and the colliery owners will themselves contribute between £400,000 and £500,000 towards its cost during the period ending with 1945.

According to *Nature*, a million dollars has been set aside by the British Council for the Promotion of Science and Technology in China as cash awards for solutions of national defense scientific problems. The Council for the Promotion of Science and Technology has selected ten special industrial and scientific problems for consideration. Chinese men of science, industrial technicians and research workers are invited to engage in studies and research on these problems and submit reports of their results to the council before the end of the current year.

The South African Standards Institution, which is the national standardizing body in the Union and incorporates the South African branch of the British Standards Institution, recently reelected Professor John Orr as chairman. He has led the standardization movement in South Africa since its inception more than thirty years ago.

It is reported in the daily press that the University of Lublin, Poland, has been formally adopted for the duration of the war by Fordham University. The Reverend Robert I. Gannon, S.J., president of the university, pointed out that the adoption was "a slight return for the cultural help and influence which our universities have received from the Old World."

DISCUSSION

TRYPTOPHAN AND PHYTOHORMONE PRECURSORS

It has been shown by different workers[1,2,3] that certain plant tissues, upon alkaline hydrolysis, give much larger yields of auxin than unhydrolyzed tissues. This and related work has established the existence of one or more naturally occurring compounds which have been called auxin "precursors"; they become auxin only after suitable treatment. The chemical identity of such precursors has not been established, but a suggestive paper has been published recently.[4] It reports that the amino acid tryptophan, upon alkaline hydrolysis, yields an auxin which is presumably

---

[1] G. S. Avery, Jr., J. Berger and B. Shalucha, *Amer. Jour. Bot.*, 28: 596–607, 1941.

[2] A. J. Haagen Smit, W. D. Leech and W. B. Bergren, *Amer. Jour. Bot.*, 29: 500–506, 1942.

[3] E. S. J. Hatcher, *Nature*, 151: 278–279, 1943.

[4] S. A. Gordon and S. G. Wildman, *Jour. Biol. Chem.*, 147: 389–398, 1943.

indoleacetic acid; and that tryptophan-containing proteins (casein and several purified protein preparations from spinach leaves) similarly yield auxin upon treatment with alkali. From these results the authors[4] conclude that "it is not improbable that tryptophane does occur as such in plants, and until it can be definitely shown that there is no conversion of this substance to auxin under the influence of alkali treatment, reported increases in auxin liberation must be viewed with misgiving." This implies that yields obtained by alkaline hydrolysis are in the nature of artifacts. But, rather than causing "misgiving" over the alkaline hydrolysis method, it seems to us that the paper in question supports its value as an extraction method, *i.e.*, it may be such substances as tryptophan in plant tissues which are the precursors. Indeed, it has been reported that tryptophan is convertible to auxin by plant tissues[5,6] and by ultra-violet light.[7]

It has been shown[1,2,3] that approximately 90 per cent. or more of the total auxin obtainable from kernels of corn, wheat and rye is present in the kernels not as auxin, but as a precursor. Thus there is an enormous conversion of a physiologically inactive compound into auxin. Before attaching too much importance to the possibility of tryptophan being the precursor in corn and wheat, it is to the point to compare the magnitude of the conversion obtained from pure tryptophan and that from plant tissue. The maximum yield of auxin (calculated as indoleacetic acid) from alkali treatment of tryptophan is 0.008 per cent., and from a tryptophan-rich protein, casein, is 0.001 per cent. (Gordon and Wildman, tables 3 and 4).[4] In contrast, the maximum yield of auxin from alkali treatment of fresh whole grains of sugar corn is 0.084 per cent. (84 million TDC per gram), calculated on dry weight of the corn.[8] This is at least ten times as high as the conversion from pure tryptophan. If our figures are correct, they indicate that the precursor in corn is not tryptophan.

Evidence in favor of the non-artifact nature of the auxin produced by alkaline hydrolysis of corn is provided by the experiments of van Overbeek.[9] Using a technique which involved exhaustive diffusion, van Overbeek reports that about 90 per cent. of the total auxin obtainable from the coleoptile tips of corn seedlings occurs not as auxin, but as a precursor.

Wheat, upon alkaline hydrolysis, has been reported[1,2] to give increases in auxin yield up to 3 to 6 mg indoleacetic acid per kg of kernels (over that of unhydrolyzed tissue). Contrary to the calculation of Gordon and Wildman, which seems to be in error by a factor of one million,[10] such increases are very much in excess of any activity obtainable from the tryptophan in wheat.

It has been pointed out in the work of this laboratory that the alkaline hydrolysis method is unsatisfactory for a number of green tissues.[8] These tissues presumably contain tryptophan, but it is obvious that the conversion of tryptophan to auxin was too little to be detected.

From diffusion curves, Gordon and Wildman (see their Fig. 1) conclude that the auxin produced is probably indoleacetic acid.[11] It should be noted that indoleacetic acid is stable to strong alkali: whereas no auxin is obtained from tryptophan with 0.25 N sodium hydroxide at 100° C. for 15 minutes, identical treatment of corn gives maximum auxin yields. Thus, it is unlikely that indoleacetic acid is the auxin produced from tryptophan by alkaline hydrolysis.

In Table IV[4] the data show that mild acid treatment of tryptophan (phosphate buffer at pH 4.6) gives higher yields of auxin than any other treatment described in the paper. Opposed to this is another datum in the same table, that a tryptophan solution adjusted to pH 4.6 gives no auxin. These results are difficult to understand. If the former is correct, it is still further evidence that the auxin precursors in corn and wheat are not tryptophan, since they do not give auxin under such conditions.

The tentative conclusion that tryptophan is not identical with the corn and wheat auxin precursors rests chiefly on the fact that the per cent. conversion of natural precursors to auxin is very much higher than that of pure tryptophan to auxin. Since it might be argued that tryptophan would show a higher percentage conversion into auxin in the presence of plant materials, we have hydrolyzed mixtures of tryptophan and ground corn kernels, and tryptophan and purified corn auxin precursor in varying amounts by weight, at pH 9.7 for 30 minutes. Avena assays indicate no appreciable increase in auxin yield from the tryptophan in either case. For example, 250 mg ground dry sugar corn alkali-hydrolyzed in the presence of 100 mg of *l*-tryptophan (Merck) gave 17.6° curvature at 1 : 16,000, compared with 13.8° curvature for corn hydrolyzed alone. The curvature attribut-

---

[5] F. Skoog, *Jour. Gen. Physiol.*, 20: 311–334, 1937.

[6] W. S. Stewart, *Bot. Gaz.*, 102: 801–805, 1941.

[7] A. Berthelot and G. Amoureux, *Compt. Rend.*, 206: 699, 1938.

[8] G. S. Avery, Jr., J. Berger and B. Shalucha, *Amer. Jour. Bot.*, 29: 765–772, 1942.

[9] J. van Overbeek, *Amer. Jour. Bot.*, 28: 1–10, 1941.

[10] Correspondence from Dr. Gordon recognizes that his 0.6 mg should be 500 grams (G. and W., p. 397). The agar block size referred to on page 389 of their work, Dr. Gordon informs us, should be 9 cmm, and the subsequently calculated figure should be 1.8×10^{-4} µg.

[11] A number of other possible intermediates of tryptophan breakdown were eliminated because of their physiological inactivity, although indolepyruvic acid, a very likely intermediate with 1.0 per cent. of the activity of indoleacetic acid, seems not to have been considered (suggested by Skoog[5]). 2-Indoleacetic acid is also a possible product.

able to tryptophan conversion is equivalent to a 0.015 per cent. yield of indoleacetic acid from pure tryptophan, versus a 0.022 per cent. yield of indoleacetic yield from crude corn. If tryptophan were the corn auxin precursor, then corn would have to be pure tryptophan, which is obviously absurd. It may be safely concluded, therefore, that tryptophan is not the corn auxin precursor to which most of the auxin activity is attributable.

On the other hand, it may be concluded from the work of other investigators[5,6] as well as from that of Gordon and Wildman, that tryptophan is a plant auxin precursor of a low degree of activity. Their results[4] suggest that auxin yields obtained from green tissues by methods involving extraction periods of many weeks[12] may possibly be attributable to tryptophan conversion into auxin.

G. S. AVERY, JR.
J. BERGER

CONNECTICUT COLLEGE

THE ROOTS OF SPINAL NERVES

EVERY one acquainted with the structure and function of the spinal nerves is aware of their threefold origin. Although this fact was recognized and generally accepted during the closing years of the nineteenth century, present-day descriptions of the spinal nerves continue to be based on the knowledge of a still earlier day. Consequently, they are initially misleading and always cause the beginner unnecessary difficulty in gaining an appreciation of the sources and functions of the fibers in peripheral nerves.

Each spinal nerve contains axons arising from cell bodies located in dorsal root ganglia, in the spinal gray matter and in the ganglia of the sympathetic chain. Fiber bundles from the first two mentioned sources are known as roots of the nerve, but the bundle from the third source is reduced to the status of a branch or ramus in all current descriptions. There seems to be no reason for continuing this erroneous designation except long-established custom. While it is true that the gray root is much smaller and joins the rest of the nerve at a point some distance removed from the union of the dorsal and ventral roots, such differences are mere details of pattern in comparison to the complete reversal of meaning occasioned by referring to a root as a branch; or, in the sense that these terms are employed, in speaking of a contribution as a derivative.

To obviate the above-mentioned misnomer in present terminology the following changes in the description of spinal nerves are proposed: (1) With an occasional exception, all spinal nerves are formed from three roots, a dorsal, a ventral and a gray (sympathetic). (2) Every spinal nerve gives rise to three primary rami and some of them give rise to four; the constant rami are the dorsal, the ventral and the recurrent, while the one arising from only certain of the nerves is the white (visceral) ramus. A white ramus springs from each of the thoracic nerves, the cranial three lumbar and the third and fourth sacral nerves; in addition, a white ramus may issue from the eighth cervical, the fourth lumbar or the second sacral. (3) The trunk of the spinal nerve is the portion between the roots; *i.e.*, it extends from the junction of dorsal and ventral roots to the point where the gray root joins the bundle formed by the union of the other two. By this definition the dorsal, the recurrent and the anterior rami arise directly from the trunk; but the white ramus is peculiar in that it may arise from the trunk, from the anterior ramus, or pass to the sympathetic chain enclosed in a sheath common to it and the gray root.[1] As to the composition of the rami with respect to the triple origin of the parent trunk, the dorsal and ventral rami contain fibers from all three roots, the recurrent carries fibers from the dorsal and the gray roots, and the white ramus receives fibers from the dorsal root and from the ventral root. It is to be noted that the white ramus alone carries dorsal and ventral root fibers only as implied for all rami in the usual introductory description.

That all spinal nerves have not two roots, but three, is factually correct. The question raised is: Shall all three roots be known as such or shall one of them remain disguised as a ramus and so continue to confuse and confound those who must eventually learn that the nerves to skin contain not only afferent fibers but efferent fibers as well; that in nerves to muscle, fibers from all three sources are generously represented; and that the white rami instead of being strictly efferent contain abundant afferent fibers? The author is aware that some afferent fibers may course with the gray ramus, that dorsal roots apparently carry efferent impulses as well as afferent, and that the possibility of afferent fibers in the ventral roots may not be excluded entirely. However, the errors imposed in neglecting to mention these facts in an introduction to the subject seem trivial compared to the continued persistence of the term "gray ramus" when the structure so named has long been established as a root—and an important one—of each and every spinal nerve.

DONALD DUNCAN

LOUISIANA STATE UNIVERSITY

TAXONOMY AND GENONOMY

SYSTEMATIC biology has been occupied in the past primarily with the end results of speciation. The object of practising systematists has been to define the limits of the entities which they have discovered and to arrange them according to their resemblances. The methods employed have been principally those of comparative morphology. The relationships within these entities and the intraspecific structure which is conditioned by the ecology of reproduction have been neglected or but little attended to. Either they have been overshadowed by the practical necessity of creating a workable system, or their study has lagged because of the inadequacy or absence of the necessary techniques. In recent years, however, some systematists, augmenting the orthodox methods by others more suitable, have undertaken to analyze these phenomena. They have become interested not so much in the broader relationships which exist between species and between genera, relationships which can be inferred only from observation and on which no experimental attack is possible, but in the more intimate familial relationships of the individuals which comprise a species. By these studies it is hoped that they may peer beyond the end results of speciation and learn more directly its causes and course. They also believe that thereby a more satisfactory arrangement can be devised.

---

[12] K. V. Thimann, F. Skoog and A. C. Byer, *Amer. Jour. Bot.*, 29: 598–606, 1942.

[1] D. Sheehan and J. Pick, *Jour. Anat.*, 77: 125, 1943.

Several terms have been applied to such studies; they have been variously described as the "new" systematics, as biosystematics and as population genetics. These terms are awkward and are not wholly revealing. None has gained more than tentative acceptance despite the need for a term which can be generally applied. I am venturing therefore to propose the term *genonomy* to connote these laws of the blood relationship, coined from the Greek words τὸ γένος (the race or offspring) and ὁ νόμος (the law or ordinance). This term can be used in apposition to the term *taxonomy,* which can be defined as the laws of arrangement and employed to connote what Turrill has termed "alpha" taxonomy. If the need is felt for a more inclusive term to embrace both fields of activity, I suggest that the term *systematics* be used in this broader sense. As employed at present it is somewhat ambiguous, but more or less synonymous with taxonomy. To illustrate concretely by a study in progress: "The Systematics of *Delphinium Hansenii*" would subsume both its taxonomy and its genonomy. The former would embrace the usual studies of arrangement: nomenclature, differentiation and description of the entities and their geographic distribution. The latter would embrace studies entailed by the familial relationships of individuals, such as their breeding structure, intraspecific variation and its distribution, ploidy, the investigation of certain natural hybrids and the relationship of the entities involved in the polyploids and hybrids.

CARL EPLING

UNIVERSITY OF CALIFORNIA

ISOLATION OF INFLUENZA A BY INTRA-ALLANTOIC INOCULATION OF UNTREATED THROAT WASHINGS

WE wish to report that in this laboratory it has been possible to isolate and identify influenza virus A from untreated, unfiltered throat washings by intra-allantoic inoculation of developing chick embryo. The Hirst red cell agglutination-inhibition test was used for identification.

During a current epidemic twenty untreated unfiltered throat washings freshly collected in 20 per cent. normal horse serum saline have yielded four positive agglutinations on the first passage. One of these was verified as Influenza A by the agglutination-inhibition test.

Details of further studies will be published later.

MINNIE THIGPEN
JAMES CROWLEY

INFLUENZA LABORATORY,
DIVISION OF PREVENTABLE DISEASES,
MINNESOTA DEPARTMENT OF HEALTH

SCIENTIFIC BOOKS

NATURALIST AT LARGE

Naturalist at Large. By THOMAS BARBOUR. 314 pp. Little, Brown and Company, Boston. 1943.

WE use the expression "emergent evolution" to designate apparent mutations, which are really due, not to any change in the germ-plasm, but to a new combination of genes, giving a result which may be as wonderful as it is unforeseen. We must suppose that the elements which, coming together in the right manner and proportion, gave us Thomas Barbour, existed in his ancestors, even in those remote ancestors who would now be called savages. We are filled with a sense of wonder and mystery when we think of these early origins, destined to find their highest significance in a future then remote. If we ask what these elements were, we find the answer in Barbour's book. An intense curiosity about the phenomena and significance of animal life, a desire to discover facts hitherto unknown, a very keen sense of the beauty of nature, a remarkable capacity for friendship—all these faculties, separately or in combination, must have served Barbour's ancestors well, but it was a happy chance that brought them together in a single outstanding individual. But even so, nurture had to be added to nature, or the results might have been insignificant. Says Barbour: "I knew Professor Henry Fairfield Osborn, the president of the Zoological Society, because one of his sons was a schoolmate of mine. To me, a shy fifteen-year-older in those days, he seemed very awesome, but one Saturday afternoon he did something which enriched my life more than he ever realized. On this occasion he sat down beside me in the train going back from the Bronx to Grand Central Station. He asked me what I had been reading and then said: 'There are four great books for boys who like natural history.' And he named them: Wallace's 'Malay Archipelago,' Belt's 'The Naturalist in Nicaragua,' Bates's book on the Amazon, and Hudson's on the La Plata region. Well, I read them in this order. Wallace's book, coming first, made the greatest impression; I read it over and over again until I knew it almost by heart. And my desire to see the Dutch East Indies became so all-consuming that I must have seemed a veritable monomaniac to my parents."

Barbour thus stepped into Wallace's shoes, for in many respects the two men were very much alike. I think especially of their delight in the beauty and variety of nature, for although they wrote no poems, they had to the full the feeling which inspires the best poetry.

The book is divided into three parts—(1) The Making of a Naturalist; (2) The Sedentary Naturalist; (3) The Leisurely Naturalist—with also a couple of appendices. Each chapter deals with some special topic, the result being more interesting than a strictly chronological narrative. There is a very good chapter on Mr. Justice Holmes, of whom it is said:

> I still believe that had Justice Holmes known as much about science as he knew about philosophy, ethics, logistics or history, he would have been forced to admit that there are certain categories of facts for which science holds no key. And this is where the deist, the humble soul who makes no parade of his religious belief, feels positive that he has something quite tangible, which the atheist has not. Justices Holmes was completely happy and satisfied but, in regard to science, he was extraordinarily trusting and uninformed. With all his learning, with all his vast and mature scholarship which gave him that superb beauty of utterance, of imagery, and of apt quotation which decorated the ornate loveliness of his literary style, Mr. Holmes still had his blind spot.

But Barbour concludes: "Justices Holmes was one of the greatest men I ever knew well—if not the very greatest."

Barbour's life work has been in and for the Museum of Comparative Zoology at Harvard, where he has been the successor of Louis and Alexander Agassiz. He describes the growth of the museum and the work of his associates, and tells some strange tales of earlier days. "You see, my thesis is that working in a museum used to make people odd. Of course, that's not the case of my colleagues or me. As one of my daughters said of us, 'You don't have to be crazy, but it certainly helps.' "

There is much to be said about the Barro Colorado Island Laboratory in the Panama Canal. Barbour says that if ten friends of his were asked to speculate on the best job he had ever done, nine would agree that it was the help given to the Barro Colorado Laboratory. However this may be, the service rendered was very great, and although, under the stress of war, the laboratory is now closed, the work will continue in days of peace, presumably for centuries to come, and will be a source of inspiration to many generations of naturalists.

> Probably few spots in the world have provided more intellectual thrills or satisfied more intellectual curiosity than has Barro Colorado Island. Every naturalist, be he high-school teacher or independent investigator or college professor of biology, craves a chance to see a tropical rain forest, if only for once in his life, and many who have had their first chance on Barro Colorado Island have returned there again and again. . . .
>
> I don't know whether I shall ever see Barro Colorado again, but I certainly hope that I may, if only to sail by it through the Canal in the month of March, when the guayacan trees lift their lofty heads above the forest top, each as glittering as a golden dome, while the purple Jacarandas, the pale pink alemendros and the Palo Santo with flowers as crimson as arterial blood make a scene of incomparable splendor [pp. 206, 207].

The chapter "In Retrospect" is an attempt at self-analysis, as objective as he can make it. He says: "This year, in the midst of a war-torn world, I have been thinking hard about the whole question which every elderly person in an administrative capacity has been pondering—as to whether or not he is pulling his weight in the boat at times like this. Or should I shut the museum up and walk away from it for the duration? . . . Well, the stars have shone for me in the form of some lines recently written by my friend, Dr. Albert Eide Parr, the distinguished new director of the American Museum of Natural History in New York." Parr's statement concludes with these words:

> The effort of our physical victory may also prove wasted if in the meantime we have lost on the spiritual front. And I do not propose to apologize for having sufficient faith in our ultimate victory to consider the continued growth and development of the cultural and educational institutions to be one of the most essential duties which can be borne in our nation to-day, second only to the duty of those defending our right to have the civilization we want. At least that is the conviction in which I myself carry on.

It is natural that different individuals, according to their training and circumstances, should feel differently about these matters, so also the same individual at different times. But one feels that some of the things done, such as the evacuation of the three great museums at San Diego, which would have contributed greatly to the education of the men in service, has resulted from a feeling of indifference to cultural values on the part of those in authority. Let us hope that in the days to come the better life which we now see through dark glasses may not only restore our civilization but make it far more interesting and serviceable to the average man.

T. D. A. COCKERELL

DESERT MUSEUM,
PALM SPRINGS, CALIF.

DEVELOPMENTS IN SCIENCE

Forward with Science. By ROGERS D. RUSK. Alfred A. Knopf Company. 307 pp. $3.50.

THIS book by Rogers D. Rusk, is intended as a guide to non-scientists, to keep them in touch with the present developments in science and to review for them some of the philosophical implications, as well as to describe the practical consequences of the thought of the past two decades. It is not intended to be a text and therefore fits into the category of the other books explaining science to the layman, such as the familiar ones by Jeans and Eddington.

Dr. Rusk sets forth for the average layman the points of view which have been developed by science in recent times and outlines some of the interesting results. He starts out by explaining the triumphs of modern physical science and discusses the structure of matter and the newly discovered fundamental particles. He then shows us immediately how these particles are used. He devotes one chapter to the electron microscope, another to x-rays, and still others to artificial radio-acitvity and atomic energy. Then Rusk describes cosmic rays and reviews the evidence for the age of the earth. The remainder of the book is devoted to a more philosophical view of the problems posed by modern science. The author explains the difficulties of the mechanistic view and the importance of the development of the wave and probability concepts which form the basic operational philosophy of modern physics. His later chapter headings are suggestive, as "Reaching for the Stars," "Does Nature Make Sense?", "Man Outgrows Mechanism" and "Human Freedom and Destiny."

Finally, toward the end of the book Rusk also considers science and destruction. He attempts to set at ease the minds of those who worry about the destructive forces unleashed by science by reminding them that science provides power and tools for the use of mankind and that it is not the fault of science that some of these tools have been used by misguided persons for destructive purposes.

Dr. Rusk, being himself a physicist, is, of course, thoroughly conversant with his subject and cites extensively the original fundamental and significant experiments. He has clearly explained the rather complex ideas which have been formulated and developed by the leaders of present-day physical thought, such as Heisenberg, de Broglie, Schrodinger and Bohr. Since physics has grown during the past ten years to vast dimensions it is impossible to do justice to all phases of it in a book of this length. One is therefore left with the feeling at the end of many chapters that more should have been added about the subject and that the arguments and treatments are incomplete. Also, in reading the book a physicist would feel that in Dr. Rusk's development of the subject he departs from the classical order of presenting the material. This departure from the traditional presentation tends to give the impression that the author jumps around too much for so broad a field and does not always finish the ideas which he has started to explain. On the other hand, many of the facts in the book are excellent and certainly reflect the current thought in physics. Many of us have felt, as does Dr. Rusk, that the philosophical point of view developed by Jeans and Eddington had gone beyond the true province of science, particularly in Jeans' discussion of determinism and in his famous conclusion that since physics is mathematical, therefore God must be a mathematician. It is most encouraging therefore to hear a fellow physicist point out the difficulties with this point of view and to hear him explain the feelings which have been commonly shared by many of us in this field.

On the whole, Rusk has done a good job, and has presented the subject to the layman in a most interesting and readable book.

S. A. KORFF

NEW YORK UNIVERSITY

SPECIAL ARTICLES

RETARDATION OF RANCIDITY BY SULFHYDRYL COMPOUNDS

BIOLOGICAL antioxidants, as food constituents, are attracting increasing attention. Apart from the tocopherols, which Mattill and his associates first demonstrated as having antioxygenic potency,[1, 2] crude

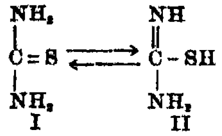
---

[1] H. S. Olcott and H. A. Mattill, *Chemical Reviews*, 29: 257, 1941.

sources of the vitamin B complex have also, recently, been recognized as potent antioxidants.[3, 4, 5]

In the course of investigations dealing with the retardation of rancidity in dried milks,[5] thiourea was examined as a possible antioxidant for fat. It has been claimed that thiourea is a good stabilizer for ascorbic acid[6] but its possible antioxygenic effect on fats required special study. From such experiments[5] it became evident that thiourea is capable of acting as a fat antioxidant, but only in the presence of water.

It is plausible to assume that the antioxygenic properties of thiourea (I) can be attributed to the sulfhydryl residue in its tautomeric form, isothiourea (II).



This idea carries with it several practical implications which are open to experimental verification.

1. Iso-thioureas having a substituent attached to the sulfur atom should not exhibit antioxygenic properties. On the other hand, *N*-substituted thioureas having a hydrogen atom available for enolization should act as antioxidants.

2. Other sulfhydryl compounds, for instance, cysteine (but not cystine), should also be good antioxidants, at least *in vitro*.

3. Cu^{++} and Fe^{+++} ions should inhibit the antioxygenic potency of sulfhydryl compounds.

Experiments were set up to test the above postulates. For the assay method a modified dried system[7] was used, composed of cornstarch (18 gram), redistilled linoleic acid (3.5 gram) and antioxidant (43 mg), with or without the addition of water (1 gram of water replacing 1 gram of starch) and of $CuSO_4$ (10 mg in the total mixture). The ingredients were thoroughly mixed and incubated at 30°. On the eighth day the fat was extracted with $CHCl_3$ and the iodine number determined.

The experimental results contained in Table I indicate the correctness of the assumption, according to which, sulfhydryl-compounds by virtue of their free sulfhydryl radical retard the development of rancidity in fat, but only in the presence of water and in the absence of copper salts (also of ferric salts, and possibly of other inhibitors of the sulfhydryl radical).

TABLE I

EFFECT OF WATER AND OF $CuSO_4$ ON THE ANTIOXYGENIC POTENCY OF SULFHYDRYL COMPOUNDS AND OF HYDROQUINONE-MONOBENZYLETHER

Antioxidant (0.2 per cent.)	H_2O per cent.	$CuSO_4$ mg.	Iodine No.	
			Exper. 1	Exper. 2
Cysteine	0	0	43.5	
Cysteine	4.65	0	113.8	114.1
Cysteine	4.65	10	46.6	42.4
Cystine	0	0	54.5	
Cystine	4.65	0	55.9	
N-Acetylthiourea	0	0	55.4	
N-Acetylthiourea	4.65	0	122.0	128.5
N-Acetylthiourea	4.65	10	81.7	48.7
S-Methylisothiourea	0	0	51.2	
S-Methylisothiourea	4.65	0	49.6	56.3
S-Methylisothiourea	4.65	10	....	44.5
Thiourea	0	0	54.8	64.5
Thiourea	4.65	0	120.2	125.2
Thiourea	4.65	10	47.8	48.7
Thiouracil	0	0		64.8
Thiouracil	4.65	0		140.9
Thiouracil	4.65	10		57.0
Hydroquinone-Monobenzylether	0	0		138.4
Hydroquinone-Monobenzylether	4.65	0		141.2
Hydroquinone-Monobenzylether	4.65	10		137.1
Control (no antioxidant)	0	0	60.5	55.3
Control (no antioxidant)	4.65	0	63.5	57.3
Control (no antioxidant)	4.65	10	50.3	50.9

It is improbable that the effect of the copper salt is due to its inherently pro-oxygenic character rather than its effect in blocking the sulfhydryl group. If the former were the case the strong antioxidant, hydroquinone-monobenzylether, should also be inactivated by the copper ion. Such inactivation, however, could not be demonstrated (Table I).

The special interest in the retardation of autoxidation of fats by sulfhydryl compounds lies primarily in the unexpected finding that *fats* are protected by such antioxidants only in the presence of *water*. In the second place, this same phenomenon may shed light on the mechanism under-lying the hypometabolic state in rats fed certain sulfonamides as well as thiourea and its derivatives.[8, 9, 10] Thiourea and thiouracil have been found to be effective also in thyrotoxicosis in man.[11, 12]

Similar to the effect of sulfhydryl compounds on the enlargement of the thyroid of the rat, there has been found a definite synergism in this respect between p-aminobenzoic acid and sulfonamides[10] as op-

---

[2] See also K. Hickman, *Ann. Rev. Biochem.*, 12: 353, 1943.

[3] P. György and R. Tomarelli, *Jour. Biol. Chem.*, 147: 515, 1943.

[4] D. F. Clausen, R. H. Barnes and G. O. Burr, *Proc. Soc. Exp. Biol. and Med.*, 53: 176, 1943.

[5] M. B. Williamson—To be published.

[6] See W. R. Fearon, *Brit. Med. Jour.*, 2: 95, 1942.

[7] P. György, R. Tomarelli, R. P. Ostergard and J. B. Brown, *Jour. Exp. Med.*, 76: 413, 1942.

[8] J. B. Mackenzie, C. G. Mackenzie and E. V. McCollum, SCIENCE, 94: 518, 1941.

[9] C. G. Mackenzie and J. B. Mackenzie, *Endocrinology*, 32: 185, 1943.

[10] E. B. Astwood, J. Sullivan, A. Bissell and R. Tyslowitz, *Endocrinology*, 32: 210, 1943.

[11] E. B. Astwood, *Jour. Am. Med. Asn.*, 122: 78, 1943.

[12] R. H. Williams and G. B. Bissell, SCIENCE, 98: 156, 1943.

posed to their normal antagonism in bacteriostasis. A direct antioxygenic reaction might be the cause for this synergism which hitherto has defied any plausible explanation. The enhancing effect of p-aminobenzoic acid on sulfonamides in the retardation of rancidity in fat has recently been experimentally demonstrated.[13]

More experimental evidence is needed before the link between antioxygenic activity of thiourea and related substances and their effect on metabolism and the thyroid gland can be regarded as established.[13]

PAUL GYÖRGY
ERIC T. STILLER
MARTIN B. WILLIAMSON
BABIES & CHILDRENS HOSPITAL AND THE
DEPARTMENT OF PEDIATRICS, SCHOOL OF
MEDICINE, WESTERN RESERVE UNIVERSITY,
CLEVELAND AND THE RESEARCH LABORATORIES,
S.M.A. CORPORATION, CHAGRIN FALLS

VITAMIN B_6 DEFICIENCY ANEMIA IN THE DOG[1]

HYPOCHROMIC microcytic anemia typical of vitamin B_6 deficiency in puppies and adult dogs has been produced in this laboratory consistently, thus confirming the work of others.[2,3,4,5,6] The synthetic basic diet used was high in protein and consisted of the following ingredients: casein 40 per cent., sucrose 36, cotton seed oil 18, cod liver oil 2, mineral salts[7] 4 per cent. This diet is essentially free from all members of the vitamin-B complex.

EXPERIMENTAL GROUPS

Group I—consisting of nine animals—received in addition to the basic diet seven synthetic members of the vitamin B complex as follows: thiamin 1.4 mg, riboflavin 0.7 mg, nicotinic acid 6 mg, inositol 6 mg, pantothenic acid 6 mg, para aminobenzoic acid 6 mg, and choline 30 mg per dog per day, but no vitamin B_6. All these dogs developed the hypochromic microcytic anemia observed in dogs lacking vitamin B_6. The initial hemoglobin of these dogs averaged 15.5 grams. This rose to a peak of 18.8 grams in approximately 7 weeks, then declined to values averaging 7.7 grams after 22 weeks on the diet. For other blood values see Table I.

Group II. As a control group five puppies were placed on the same régime except that vitamin B_6 was given as a supplement (6 mg per dog per day) from the beginning of the experiment along with the other seven synthetic vitamins. Much to our surprise under these conditions the blood values (determined every two weeks) followed a pattern quite similar to that of the vitamin B_6 deficient animals (Fig. 1). Their initial hemoglobin values averaged 14.5 grams. These rose to a high value of 18.6 grams in 4 weeks, then declined gradually to 9.4 grams over a period of 20 weeks.

Group III. As an additional control group, 4 animals (1 adult and 3 puppies) received the basic diet altered to contain brewers' yeast, as a source of all the B-complex vitamins, at a level of 10 per cent., replacing an equivalent amount of carbohydrate. The initial hemoglobin values in this group averaged 14.5 grams, rose to a peak of 19.8 grams after 17 weeks on the diet and then returned to a value around 18 grams, a level which was maintained throughout the rest of the experiment.

Group IV—composed of 4 puppies—received the same yeast control diet as group III, but in addition these animals received the eight synthetic vitamins given to group II and in the same daily amounts. Here the average initial hemoglobin was 13.5 grams with a peak averaging 20.5 grams after 21 weeks and a subsequent return to a value around 18 grams. Fig. I illustrates the contrast in behavior between the animals receiving only synthetic vitamins and their yeast controls.

One puppy of group I after being depleted of vitamin B_6 was subsequently treated with vitamin B_6 and later with brewers' yeast. The results substantiated the findings in groups II and III. At the end of the depletion period of 36 weeks this dog had a Hgb. of 6 grams, a red blood count of 4,570,000 and a hematocrit of 18.5 volumes per cent. Treatment with vitamin B_6 resulted in the usual prompt rise in hemoglobin, which increased 4 grams in 6 days with a corresponding rise in the other blood values. The hemoglobin then gradually rose to 15.5 grams in 10 weeks with a corresponding RBC of 6,720,000 and a hematocrit of 41.9. The hemoglobin could not be maintained at this level and fell gradually over a period of 6 weeks to 12 grams (RBC 5,580,000, hematocrit 37 vols. per cent.), after which it began to rise under the influence of the yeast treatment. After 13 weeks on this régime a hemoglobin value of 18.5 grams with a red count of 7,500,000 and hematocrit of 46.8 vols. per cent. was obtained. The peak values were reached after 19 weeks on the yeast diet and were maintained for 14 weeks, the hemoglobin not falling below 20 grams during this time. After that the hemoglobin fell slightly and was maintained at approximately 18 grams throughout the remainder of the treatment period of one year.

---

[13] In preliminary experiments (in collaboration with Dr. R. M. Tomarelli) hydroquinone monobenzyl ether (0.5 per cent. in the diet) has no effect on the size of the thyroid in rats when administered for fourteen days. In this connection it should be noted that the effect of various antioxidants depends, to a large extent, on the substrate on which they are tested.

[1] Evidence that vitamin factors found in brewers' yeast in addition to vitamin B_6 are essential for maintaining hemoglobin in the dog.

[2] Only two adult dogs were used, one in Group I, the other in Group III.

[3] P. J. Fouts, O. M. Helmer, S. Lepkovsky, and T. H. Jukes, *Jour. Nutrition*, 16: 197, August, 1938.

[4] P. J. Fouts, O. M. Helmer, and S. Lepkovsky, *Am. Jour. Med. Sci.*, 199: 163, 1940.

[5] H. J. Borson and R. S. Mettier, *Proc. Soc. Expt. Biol. and Med.*, 43: 429, 1940.

[6] J. M. McKibbin, A. E. Schaefer, D. V. Frost and C. A. Elvehjem, *Jour. Biol. Chem.*, 142: 77, 1942.

[7] Mineral salt mixture: Bone meal (steamed), 57.8 per cent.; sodium chloride, 24.4 per cent.; lime stone (oyster shell flour), 12.2 per cent.; iron sulfate (U.S.P.), 3.7 per cent.; magnesium oxide (U.S.P.), 1.2 per cent.; copper sulfate (reagent), 0.3 per cent.; manganese sulfate (reagent), 0.1 per cent.; zinc oxide (reagent), 0.1 per cent.; cobalt carborate, 0.1 per cent.; potassium iodide, 0.1 per cent.

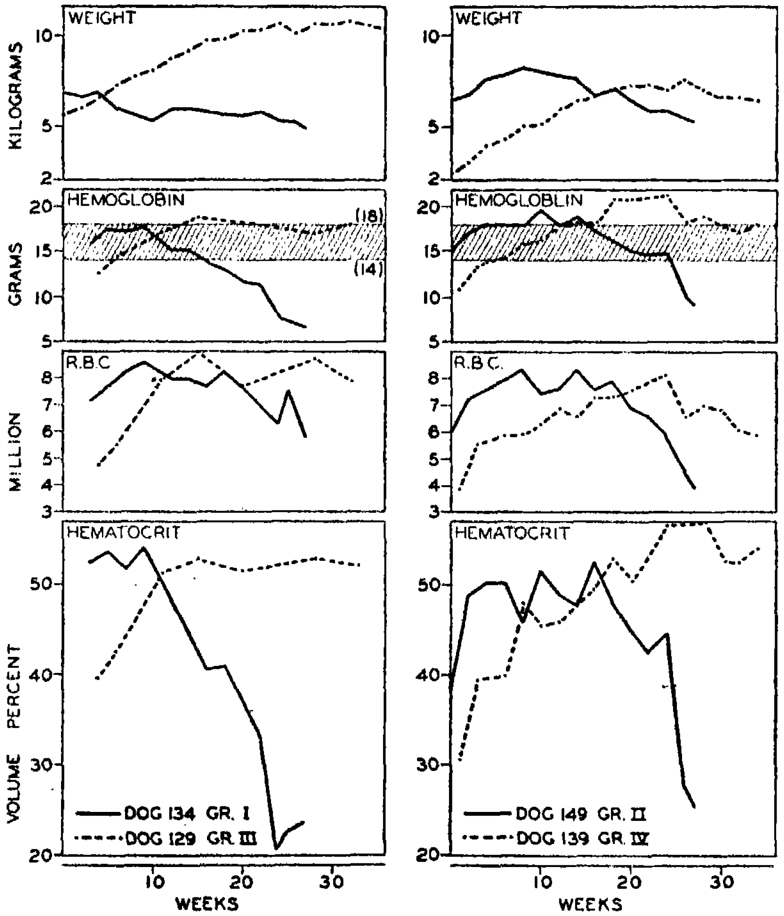


TABLE I

Gr	No dogs	Weeks to peak	Weeks on expt.	Diet	Weight				Hemoglobin			Red count		Hematocrit		
					I	H	F	I	H	F	I	H	F	H	F	I
					Kilo				grams			million		vol per cent.		
I	9	6	22	BD + (V–B₆)	5.6	5.8	4.6	15.2	18.8	7.7	6.36	8.36	5.12	47.2	26.5	52.7
II	5	4	27	BD + V	4.9	5.9	4.0	14.5	18.6	9.4	5.84	8.16	4.78	40.1	30.9	52.1
III	4	15	53	C. D.	5.2	10.6	9.6	14.5	19.7	18.0	5.98	8.92	7.83	39.8	51.6	55.8
IV	4	10	36	CD + V	4.5	11.5	11.1	13.5	20.0	19.2	5.36	8.25	7.72	37.8	54.5	54.5

I = Initial H = High F = Final

The vitamin B_6 therapy had no discernible effect on the general condition of this dog. The animal weighed 5 kilograms at the beginning of the treatment and at the end of 100 days, or approximately 14 weeks, the weight was exactly the same. There was no improvement in appetite, vitality, condition of the skin, which had a severe fungus infection, or the general alopecia. The effect of the yeast treatment on the general condition of the animal as well as the hematologic changes in the blood elements was almost miraculous. In 16 weeks the dog had doubled its weight, and almost doubled its hemoglobin and hematocrit, completely cleared up the fungus infection and grown a sleek healthy coat over areas that appeared miserably "moth eaten" at the time the treatment started. The changes in this animal served as a dramatic illustration of the importance of administering the entire B complex which is to be found only in natural sources.

Although vitamin B_6 therapy in the case of a dog with vitamin B_6 deficiency anemia produces a dramatic and apparently specific effect, yet it has been observed that B_6 alone will not bring the hemoglobin back to normal. Borson and Mettier[5] found that some of the filtrate factors were needed for more complete blood regeneration in their B_6 deficient dogs, and McKibbin and his associates[6] found that certain factors present in liver were needed before normal hemoglobin values ("13–14" grams) could be reached in their deficient animals. This was also borne out in Wintrobe's study[8] with vitamin B_6 deficient swine. In the present study the giving of all the other synthetic B-complex factors in adequate amounts was sufficient to enable the addition of vitamin B_6 alone to bring the hemoglobin back to 15.5 grams but not to maintain it at this level. Brewers' yeast at a level of 10 per cent. not only maintained the hemoglobin level but kept it at a constant value considerably higher than the accepted normal of 14.0 grams.[9] These extremely high values in the yeast-treated dogs, *i.e.*, 18–20 grams, as compared with 14 grams were viewed with some scepticism at first, but they have been repeatedly confirmed when checked in other laboratories of this hospital. The observance of hemoglobin values from 4–5 grams higher than those usually found in dogs probably reflects the fact that dogs under natural conditions of living never receive an optimum supply of the vitamin-B complex. It is not urged that this is essential, but it is probably of value in situations not fully understood at the present moment.

From these data it is concluded that even though a diet lacking vitamin B_6 results in a typical hypochromic anemia in dogs which responds specifically to vitamin B_6 treatment, vitamin B_6 alone or even combined with the known synthetic factors of the B complex is not sufficient to maintain the hemoglobin at optimum levels. There is at least one factor, possibly more, in brewers' yeast in addition to vitamin B_6 which serves to stimulate hemoglobin production in the dog.

ACKNOWLEDGMENTS

We are indebted to Merck and Company, Rahway, N. J., for the Vitamin B_6 and calcium pantothenate used in these studies, to the Fleishmann Laboratories, Standard Brands, Inc., New York City, for the brewers' yeast and to Lederle Laboratories for the material used in immunizing the puppies against distemper.

SUSAN GOWER SMITH
ROBERT CURRY
HAROLD HAWFIELD
DEPARTMENT OF MEDICINE,
DUKE UNIVERSITY SCHOOL OF MEDICINE

---

[8] M. M. Wintrobe, R. H. Follis, Jr., M. H. Miller, H. J. Stein, R. Alcayaga, S. Humphreys, A. Suksta and G. E. Cartwright, *Bull. Johns Hopkins Hosp.*, 72: 1, 1943.

[9] R. F. Scarborough, *Yale Jour. Biol. and Med.*, 3: 359, 1931.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

TECHNIQUE FOR STROBOSCOPIC STUDIES OF INSECT FLIGHT[1]

SINCE the application of the Edgerton stroboscope[2] to studies of insect flight,[3, 4] it has become clear that the frequency of wing-beat of standardized insects offers a rigorous technique in quantitative biology. There is reason to believe that the usefulness of such measurements will not be limited to studies of insect physiology, but may extend into other fields such as genetics and experimental pharmacology. It is therefore our purpose to describe the apparatus and technique that we have found most suitable for determining wing-beat frequency.

A survey of the flight of numerous insects has demonstrated that *Drosophila* is a most favorable experimental animal. Advantages offered by this genus include the year-round availability of numerous species and varieties and the generally consistent response under the experimental conditions, as well as the large body of information which already exists in regard to their structure and physiology. Furthermore, wing-beat frequency varies not only with the age and sex of the individual[5] but also with the temperature at which they are reared and flown,[6] so that these factors must be carefully controlled. The use of homogeneous, inbred strains is also highly desirable.[6] Procedures for regulating these details are better established and more easily applied for *Drosophila* than for most other insects. While the small size of *Drosophila* may be a hindrance in some types of work, as in analysis of chemical changes during flight, it simplifies the problem of mounting specimens for observation of wing movement. The relatively stiff articulation between abdomen and thorax in this genus is also helpful in this respect. *Drosophila* thus seems particularly suitable for measurement of wing-beat frequency; however, the technique described below can be applied with minor modifications to a variety of other insects.

---

[1] This study was aided by a grant from the Josiah Macy Junior Foundation.

[2] K. J. Germeshausen and H. E. Edgerton, *Electronics*, 10: 2, February, 1937.

[3] L. E. Chadwick, *Psyche*, 46: 1–8, 1939.

[4] L. E. Chadwick, *Physiol. Zool.*, 12: 151–160, 1939.

[5] C. M. Williams, L. A. Barness and W. H. Sawyer, *Biol. Bull.*, 84: 263–272, 1943.

[6] S. C. Reed, C. M. Williams and L. E. Chadwick, *Genetics*, 27: 349–361, 1942.

The specimens are fastened as indicated in Fig. 1. A series of mounts are prepared, each of which consists of a short length of copper wire soldered at one end to a pin (head removed) and glued at the other end to a narrow strip of paraffined paper. The insects are lightly etherized and further manipulations carried out under a dissecting microscope. By means of a scalpel the hind pair of legs are removed at the femoro-tibial joint in order to prevent their touching the mount and inhibiting flight. This operation has no demonstrable effect on wing movement. Next the specimen is placed belly-down on a piece of cork and the wings spread by means of a forked pin placed behind their margins. A dissecting needle with a short piece of resistance wire wrapped around its shaft is warmed electrically and used to fuse the paraffined tip of the mount carefully to the dorsal end of the abdomen. The insect is not damaged by this process and regains its flight abilities within a few minutes. After half an hour it is fully recovered from the anesthetic and ready for testing.

As diagrammed in Fig. 1, the mounted insects are fastened to a brass fitting that slides snugly into the Pyrex tube which serves as an experimental chamber. It is advantageous to enclose a number of individuals in the chamber in order to equilibrate them simultaneously with the conditions that are being tested. Each mount is fastened in place with a set screw and adjusted, by bending the copper wire so that the specimen stands on the corresponding spring platform. These springs consist of phosphor-bronze, 0.15 mm thick, cut to appropriate shape and soldered at their [illegible] ends to thin squares of soft iron. After the chamber has been sealed, the springs may be depressed [illegible] an electro-magnet placed outside the apparatus. Due to the tarsal reflex,[7] flight is stimulated by withdrawal of the platform and inhibited by its return, so that it may be controlled at the will of the operator.

The chamber, which consists of a length of Pyrex combustion tubing, is sealed by clamping it between brass end-pieces connected by three rods. The triangular end-pieces are machined to receive the ends of the chamber and fitted with rubber gaskets. With this arrangement the chamber may be made tight for pressures as high as ten atmospheres. The desired gas mixtures are supplied and pressures controlled through copper tubing provided with suitable valves and sealed into the central openings of the brass end-pieces.

Since accurate control of the temperature of the chamber is essential, the apparatus is most advantageously immersed in a water bath that is thermostatically regulated. We have found most convenient for this purpose a bath equipped with a glass-bottom offset. A mirror placed outside the bath and beneath the offset permits the animals to be studied in silhouette against the stroboscopic lamp clamped above the water surface. An extension cord leads from the lamp and reflector unit to the control box on the table below. The flight chamber is supported by a clamp so that it can be lifted from the water or moved longitudinally in front of the water-tight electromagnet, and is so oriented that the dorso-ventral axis of the animals lies in the horizontal plane. Thus, by moving the chamber, each animal can be brought opposite the magnet and tested in turn, while it is viewed through the glass offset without obstruction. The flight response of the animals does not seem to be influenced in any way by their static orientation in respect to the field of gravity. If the animals are to be studied during continuous flight, a permanent magnet may be substituted in place of the electromagnet.

By means of an apparatus thus arranged, it has been possible to measure precisely the frequency of

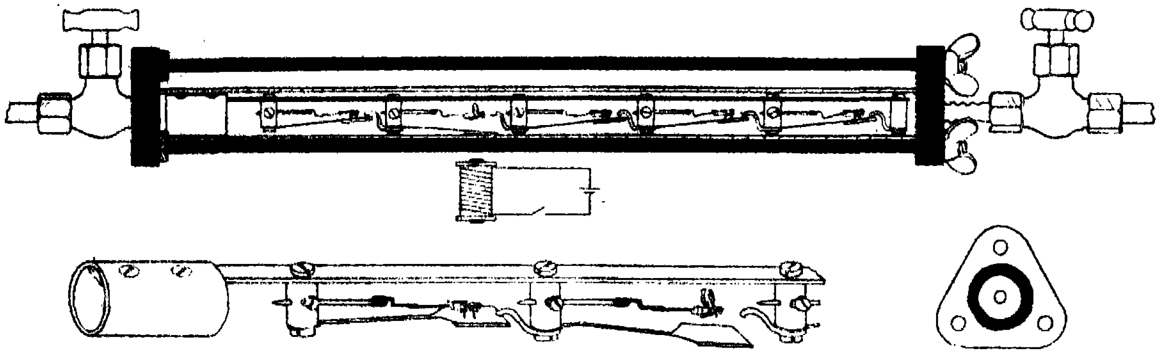


Fig. 1. Profile view of flight chamber (× ⅛), details of brass fitting and internal view of brass end-piece.

---

[7] G. Fraenkel, *Ztschr. f. Vergleich. Physiol.*, 16: 370–393, 1932.

wing-beat under a variety of experimental conditions. Many hundreds of reliable measurements may be accomplished on each individual during intermittent flights having durations of 3 to 5 seconds, separated by adequate periods of rest (about 20 seconds). Under carefully controlled conditions the variability of such determinations on a single individual is generally less than one per cent. For 24 strains of *Drosophila* the coefficient of variability among different individuals of single strains was found to average 3.10 per cent.[6] Useful information in regard to metabolism and fatigue can be obtained in terms of the progressive changes in wing-beat frequency during continuous flight.[5] The principle of the apparatus has also been adapted for measurements correlating wing-beat frequency with respiratory exchange.[8]

LEIGH E. CHADWICK
ANESTHESIA LABORATORY OF THE HARVARD
MEDICAL SCHOOL AT THE MASSACHUSETTS
GENERAL HOSPITAL, BOSTON, MASS.
LEIGH E. CHADWICK
DEPARTMENT OF PHYSIOLOGY,
UNIVERSITY OF ROCHESTER SCHOOL OF
MEDICINE AND DENTISTRY

THE COAGULUM-CONTACT TECHNIC IN TRAUMATIC RUPTURE OF THE LIVER IN DOG AND MAN

AT the suggestion of Dr. W. Wayne Babcock, it was decided to extend the principles involved in the coagulum-contact technic of skin grafting[1] to the control of bleeding and the promotion of healing in traumatic injuries of the liver and spleen. In the past it has been customary to sew the opposing surfaces of the liver together. This frequently promotes rather than controls bleeding. Likewise the packing of the injured field is often complicated by bleeding at the time the packing is removed. The new method presents neither of these difficulties.

Equal quantities of plasma and cell extract (autogenous, homologous or heterogenous) are mixed together just before using. The bleeding surfaces of the liver which are to be joined are exposed and the mixture is rapidly brushed over both surfaces with a sterile camel hair brush. The surfaces are firmly held together for about three minutes. They are then released and will adhere firmly to one another. If the bleeding is still present in poorly apposed parts, some of the mixture is brushed over these areas and left to coagulate. If there is profuse bleeding the brush may be held over the site of bleeding for one to two minutes. On microscopic examination, three days later, fibroblasts are seen to have proliferated in the coagulum formed. Five days after operation, small sinuses appear in certain sections. By the end of ten days, it is often difficult to find the line of incision on gross inspection of the specimen. Microscopically, one finds these areas well organized with very little evidence of damage to the adjacent liver cells.

Damaged surfaces of liver will adhere to one another on pressure without the interposition of plasma and extract. However, oozing does not stop so readily and when profuse bleeding occurs at the inner angle of two opposed surfaces where it is difficult to exert pressure, it is almost impossible to stop the bleeding by pressure alone. While adhesion has been 100 per cent. when using the plasma-extract mixture on fifteen dog livers and one human liver, the liver in three (or 20 per cent. of the cases) had to be restuck when no plasma-extract was used. In no case did the dog bleed to death with either method.

Similar experiments have been carried out on the spleens of dogs. Here the plasma extract gives definitely superior results but neither method is as satisfactory as in the liver. Due to the intrinsic structure of the spleen itself, infarctions are apt to occur. Again, no death actually occurred due to hemorrhage but healing was slow and unsatisfactory.

This new method is extremely simple and uses the physiologic principles of blood clotting and wound healing thus eliminating any extraneous factors which might complicate and endanger the individual's life in some other way. It is hoped that this method may be of use in the treatment of war wounds.

MACHTELD E. SANO
CLARENCE A. HOLLAND
DEPARTMENTS OF PATHOLOGY AND SURGERY,
TEMPLE UNIVERSITY HOSPITAL AND
SCHOOL OF MEDICINE

BOOKS RECEIVED

EDDY, SAMUEL and THADDEUS SURBER. *Northern Fishes with Special Reference to the Upper Mississippi Valley.* Illustrated. Pp. xi + 252. The University of Minnesota Press. $4.00.

JAMIESON, GEORGE S. *Vegetable Fats and Oils.* Pp. 508. Reinhold Publishing Corporation. $6.75.

MACDUFFEE, CYRUS COLTON. *Vectors and Matrices.* Pp. xi + 192. Open Court Publishing Co., La Salle, Ill. $2.00.

Pain. Research Publication of the Association for Research in Nervous and Mental Disease. Illustrated. Pp. xii + 468. Williams and Wilkins Company. $7.50.

RAINVILLE, EARL D. *Intermediate Differential Equations.* Illustrated. Pp. vi + 211. John Wiley and Sons. $2.75.

SPICER, WILLIAM M., WILLIAM S. TAYLOR and JO[illegible] CLARY. *General Chemistry Problems.* Illustrated. P[illegible] v + 120. John Wiley and Sons. $1.25.

---

[8] L. E. Chadwick and D. Gilmour, *Physiol. Zool.*, 13: 398–410, 1940.

[1] M. E. Sano, *Am. Jour. Surg.*, lxi, 105–106, 1943. This new method of skin grafting using plasma and cell extract to form an adhesive and growth-stimulating coagulum is being used not only at Temple University Hospital but at other hospitals with very good results.

SCIENCE

VOL. 98 FRIDAY, DECEMBER 17, 1943 No. 2555

American Learning When Peace Comes. "The Natural Sciences": DR. GEORGE GLOCKLER 525

Obituary:

Edward Burr Van Vleck: PROFESSOR RUDOLPH E. LANGER. *George West Graves*: PROFESSOR LEO F. HADSALL. *Recent Deaths* 530

Scientific Events:

Scientific and Technological Training in Great Britain; Rubber from Russian Dandelions; Finances of the University of Illinois; The World Map of the National Geographic Magazine; The Dr. William Beaumont Foundation; The American Pharmaceutical Manufacturers' Association 532

Scientific Notes and News 534

Discussion:

Statistical Treatment of Percentage Counts: DR. F. M. WADLEY. *The Germination of Dormant Lettuce Seed*: PROFESSOR G. J. RALEIGH. *Some Misleading Terminologies in the Literature of "Plant Tissue Culture"*: PROFESSOR I. W. BAILEY. *Relative Values for Descriptive Words*: DR. O. N. LIMING 536

Scientific Books:

Nutrition: PROFESSOR H. J. DEUEL, JR. *Aerial Photographs*: DR. WALTER CLARK 540

Special Articles:

The Antigenicity of Protein Isolated from Bovine Serum After Brief Treatment with Alkali: DR. RALPH J. DEFALCO, DR. LOUIS A. KAZAL and DR. L. EARLE ARNOW. *A Physical Deficiency in the Ration of Ruminants*: PROFESSOR H. H. COLE and PROFESSOR S. W. MEAD. *The Culture of Young Conifer Embryos in Vitro*: S. W. LOO and F. H. WANG 542

Scientific Apparatus and Laboratory Methods:

Hematocrit Determination of Relative Cell Volume: DR. ARTHUR K. PARPART and R. BALLENTINE. *Simple Adapters for Continuous Extraction of Aqueous Solutions in the Soxhlet Extractor*: DR. BERNARD S. GOULD 545

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

AMERICAN LEARNING WHEN PEACE COMES. "THE NATURAL SCIENCES"[1]

By Dr. GEORGE GLOCKLER

THE STATE UNIVERSITY OF IOWA

IN a consideration of the topic of American scientific learning in the post-war world, it must be understood that perhaps no other fields of human endeavor are as international in scope and attitude as are the natural sciences—astronomy, biology, botany, chemistry, geology, mathematics and physics. A great deal that can be said concerning these subjects goes far beyond the limits of national boundaries and is of importance to all human beings. However, it appears definitely worth while to consider specifically the problems of American scientific learning when peace comes so that the contributions to the natural sciences which must be made and, it may be predicted, will be made, by American scholars and workers, can be seen at least in outline and can serve as a goal to be attained. The problem of American scientific learning will be discussed on the basis of three factors: the world background as seen by scientific men, the basic qualities of the human intellect, curiosity and imagination, upon which depends all progress in the natural sciences, and the special tasks which American scientists must face in so far as these problems concern the position and growth of American scientific learning in the period following the present conflict.

In an endeavor to consider these questions one might well insist that the only problem of importance at the moment must be the winning of this global war, since failure in this task would make irrelevant any further discussion concerning the position of American scientific learning when peace comes once again. But such a negative attitude would certainly lead to no improvement in the lot of humankind and a more sensible, in fact, a desperately necessary view is to bring the problems confronting all peoples after the war into the light now, so that the future of mankind may be established on a more logical basis than has been done in the past. Will the human race have to go through an abyss of darkness, which is war, at periodic intervals; or is there hope that a new and more abundant civilization can appear on the surface of this earth? Scientifically trained men believe that the economic basis of human existence on this planet will be so profoundly affected by future scientific learning, discovery and invention and the subsequent repercussions in the economic sphere will be of such magnitude, that an age of plenty will be initiated where the present economic and political struggles between empires will tend to disappear. Perhaps no individual can offer at this moment a reasonable solution of current international difficulties as long as millions of people need food and clothing of which there is a scarcity. War and strife may be inevitable in a world in which 50 per cent. of the wealth is enjoyed by about 6 per cent. of the population. It is to be hoped that future generations will solve the problem of the distribution of wealth on a more equitable basis so that they may look back upon the present period with horror and unbelief, wondering how the social and economic injustices of to-day could ever have been perpetrated by so-called human beings. Mankind may well pray that future economic systems will not involve the existence of want in a world of plenty. May future generations learn to use the God-given abundance of this earth with wisdom and consideration for all, so that they need not curtail production while there is still want. Scientists may hope that their work and efforts will lead to a continued increase in the usable physical wealth of the world. They believe this enrichment will lead to a steady improvement in the relationships of nations, so that contending groups may gradually acquire knowledge of a proper basis for living together, just as individuals have found a way of cooperating in a society. Surely nations will learn to live and let live and some day evolve a system of association free from mistrust and suspicion and thus really attain more closely the ideal of the Golden Rule.

---

[1] This is the second of a series of ten Baconian Lectures given under the auspices of the Baconian Club, State University of Iowa, Iowa City, Iowa, on October 8, 1943.

Hence the basic thought of this thesis is that a better world civilization will be possible because the economic foundation of human existence will be profoundly altered by future scientific discovery and invention. More of the world's goods will be produced at less cost to all through scientific research. Scientific thought and learning are the very foundation on which the progress just outlined must be built. Great strides have already been made, but an enormous amount of work must be done to create a world based on greater abundance.

For the further analysis of scientific learning it is necessary to discuss the second point of this theme; namely, the two qualities of the intellect, curiosity and imagination, which are fundamental so far as science is concerned. On this basis it is possible to understand past performance and whatever future progress may be expected in the realm of scientific study and research. The present-day sciences would never have been established had there not been individuals with abounding curiosity who were willing to overcome their inherent laziness and spend time and effort, without thought of reward, in order to learn about the physical universe surrounding them. However, an inquiring mind alone would never have produced the present edifice of scientific knowledge had it not been coupled with productive imagination. The latter is the most important quality of the human intellect in relation to the advancement of scientific learning.

It is an enticing exercise to let the imagination take its flight into the future and to attempt to visualize the world of to-morrow as conceived by the scientist of to-day. The basis of this projected thought picture, must, however, be the performance of the past, so that the description rendered may not take on the cloak of ridiculous fancy nor the shape of naive fallacy. Nevertheless, errors of too great conservatism must equally well be avoided. If the advances in the natural sciences for the last few decades are considered in retrospect, it is clearly seen that the possibilities of the future are great. It is to be hoped that the picture on the whole can be an optimistic one and the consensus of opinion of scientists warrants indeed a promising outlook in spite of the dreadful events which hold men chained at present to undertakings completely destructive and utterly senseless on any rational basis.

Because psychology is the science concerned with the systematic investigation of the mind and since imagination refers to a certain category of the functions of the human intellect, it is natural that the psychologist should render an analysis of the imaginative mental process. In the early history of psychology imagination was simply defined as the ability of having mental images or pictures. However, very soon a distinction was made between the mental activity of recalling images of earlier experiences, now called reproductive imagination or memory, and the formation of new mental pictures from a combination of already known ones. This latter performance can be called productive imagination, and it is this faculty which is of interest at the moment. The imaginative exercise may be defined as the process of conjuring new mental patterns from the background of experience. The verb, conjure, is used advisedly because of its usual reference to the practise of magic.

Productive scientific imagination is certainly mental magic in the realm of scientific possibility. The sequence of mental steps involved in creative scientific thinking leads to the formation of new and hence unexperienced pictures and ideas. These new constructs of the mind must in the case of the natural sciences remain within the framework of scientific law. Hence they can not be pure fantasy. However, an audacious spirit, not too hampered by conservatism, will lead the way to further achievement. Time and again discoveries and inventions have been announced which have reached beyond the wildest flights of the imagination of even the most daring dreamers of an earlier day. It must be said that imagination is the most far-reaching power in all the world. Creative imagination lies at the basis of every great achievement accomplished by man. The minds of all the great explorers were filled with imagination. These men were consumed by a burning desire to find out what was hidden beyond the geographic horizon. This country, this America, was at one time but a dream in the mind of a Viking discoverer. This university was but a picture on the mental canvas of its founders. Does any one doubt that these men of 1850, could they be here to-day, would be amazed beyond measure to see this edifice of learning? Can it be believed that ninety years ago, they could have imagined this great institution as it is to-day? One instinctively feels that their ability to visualize the future could not have been daring enough to portray what really exists here now. Need then the scientist be timid or afraid in his own contemplations of the future? Surely after looking about and seeing the accomplishments of the human race up to the present, he may throw caution to the winds and soar into the future with all the daring enthusiasm he can summon!

It is obvious that imaginative thought is important in all fields of human endeavor. Not only does the geographic horizon incite the mind to wonder what lies beyond and, being based on visual stimuli, conjure up pictures of places and peoples strange to one's actual knowledge, but also other stimuli may arouse the imagination. One type of sense experience either perceived or remembered can be the impetus to imaginative thought processes involving fruitful speculation in other directions. A picture or a painting may give rise to the stirring of the imagination as also may a play or a book. Worlds of thought and fancy may arise in the mind from a poem heard and remembered. One truly marvels at the complexity of the imaginative process!

Turning now to the third point of this thesis, namely, the special tasks of American scientists when peace comes, it is evident that they must direct their thoughts and energies to the problems of a war-weary world. Clearly America must play an important and guiding role in the rehabilitation of the stricken peoples of this earth. A note of warning seems necessary, for it must be realized that this nation is using up its physical wealth in fuel, metals, forests and soil unstintingly at a truly alarming rate. It is certainly questionable whether or not this continent can feed all the war-torn populations. Hence, from the point of view of the dwindling resources of this country, the possibility must be borne in mind that the United States may also become a "have not nation." Her scientists will then be confronted with new problems of inventing substitutes for materials of which there is no longer an abundance. No doubt their ingenuity and imagination will bring forth a multitude of new products which will in turn initiate unforeseen developments in every phase of human endeavor.

It is indeed a fascinating undertaking to revel in predictions concerning the state of things to come in the near future. In astronomy it may be expected that the two-hundred inch telescope at Mt. Palomar will be finished and put into operation, opening new vistas of the cosmos to closer scrutiny. The Schmidt telescope and camera will very likely be constructed and should rival the two-hundred-inch instrument in power and possibilities. Astrophysicists will make further progress in their field. The age-old question of the origin of the solar system may be solved by an acceptable theory. The newer ideas indicating that solar energy arises from a series of nuclear transformations will be further discussed and developed. On the practical side astronomy will further improve the method of marine and aerial navigation. Already a tenfold increase in precision of time measurement has been made since World War I, and further advances along these lines will lead to even better control of ships and planes.

The physicist will undoubtedly carry on his investigations of the decomposition of the nucleus of Uranium isotope 235, and the tremendous amounts of power released from this fission of an atomic nucleus may be harnessed. A new form of available energy would thereby be created surpassing present means of procuring work from coal, oil and waterfalls. Even now, the warring nations, including the United States, are said to expend vast sums of money in research along these lines, to be sure at the moment directed towards the destructive purposes of war. Should it be possible to carry out this age-old dream of taming the enormous energies hidden in the atom, a new era of technology would undoubtedly be initiated.

In connection with possible power developments one can not forget the suggestion of obtaining energy from the sun by direct means, instead of depending on accumulated stores such as petroleum and coal.

Simple solar heaters have been used for decades, but large-scale units are only in the blue print stage. So far coal and oil have furnished power for industrial use more economically. The post-war period will need power projects not dependent on dwindling resources. Energy equal to twenty-one billion tons of coal which the sun showers on the surface of the globe every hour offers fascinating possibilities. At the moment the difficulty is one of expense, since large and costly installations would be needed to convert solar energy directly into useful forms. But to-morrow's reality is woven from the dream fabric of to-day! Imagine that Icarus of Greek mythology could come to life and observe the modern aeroplane! Would he not admit that reality had reached beyond his wildest visions? May it be hoped that the human spirit still possesses similar daring and adventure!

After the war American physicists will be able to return to their atom-smashing machines and obtain further information regarding the atomic nucleus. The electron microscope will bring molecules of matter into the field of direct observation. Instead of magnifications of the order of 5,000, as obtained with the ordinary microscope using visible light, magnifications of the order of twenty to fifty thousand are even now possible by substituting electrons for radiation and by replacing lenses by electric and magnetic fields. Already very large molecules have been photographed and the progress that can be imagined by further improvement of the electron microscope is really breath-taking. Had any one, only twenty years ago, mentioned the possibility that molecules can be seen, he would have had his reason questioned, for the idea is utterly fantastic and preposterous to any one acquainted only with the ordinary microscope and unaware of the possibility of substituting electron stream for light beams. More detailed knowledge of matter in exceedingly small dimensions or on the level of molecular size will bring great technical improvements in manufacturing processes.

The biologists will continue their studies of the living cell, especially from the point of view of physical chemistry. No research group is required to have a larger background of learning than does the scientist who interests himself in the phenomenon of life. The complex structures of living organisms appear to be the culmination of all natural processes known to mankind. Life seems to be the highest form of creation, certainly when considered on the basis of complexity and intricate composition, as well as in breadth of function. Hence, it is not to be wondered at that scientists have not yet learned the secret of life. However, biologists will persist in their tasks and they will undoubtedly make the most far-reaching contributions to scientific learning not only in the post-war period but also in the more distant future, especially in the field of genetics, which will be of immense value to the human race in numberless directions. Of greatest immediate importance appears to be the study of molds and yeasts which may well revolutionize the world's food situation. Yeasts can be grown in a nutrient medium and they will there reproduce themselves very rapidly. Recent researches in this country show that molasses, ammonia gas, water, air and yeast may be mixed in large tanks where the yeast will grow to furnish an edible material rich in proteins and vitamins. It is entirely feasible that this biochemical method may become a serious competitor to our cattle raisers in the matter of furnishing protein foods for the nation. Flavors can be synthesized by the chemists making the yeast-cake more palatable. Furthermore, the biologist and geneticist are already developing various strains of yeasts yielding materials of different tastes. Enthusiasts visualize a new method of food production, more economical and less cumbersome and adaptable to the crowded regions of the globe. The program is now in its initial stages, and no doubt great developments may be expected in the very near future. Mankind has used yeasts as food for centuries in bread and ale, but these newer researches will give these lowly molds an entirely new role in human nutrition.

It should be noted, however, that, after all, the yeast cells must eat and the sugar or molasses must still be obtained from vegetation. As long as the chemist is unable to carry out photosynthesis in test-tubes, it will be necessary for the botanist and plant geneticist to continue their labors and produce for human consumption ever greater varieties of plants. The amazing performance of hybrid corn is too well known to be discussed in detail. Similar and equally startling developments are just beyond the horizon. From the plant kingdom is obtained cellulose, perhaps the most versatile material in technological use. Just as the past century has been called "the age of steel," so it has been predicted that the coming era will be called "the age of cellulose." If present demands on the iron ore deposits of this country continue for any length of time, there is no doubt that a serious metal shortage will have to be faced and many articles of commerce will be made from synthetic lumber or artificial wood derived from cellulose specially grown for this purpose under the guiding hand of the botanist and treated by the chemist for its varied uses. Moreover, cellulose when digested with water and acids changes into starch-like materials and sugar-like substances which have nutrient value and can serve as food. This wonderful substance in the form of lumber can house man; in the form of cotton and rayon, it can clothe him, and after chemical treatment, it can serve as his food!

The thought just expressed, that the present metal economy may be changed as the natural resources of this country dwindle, leads to the consideration of possible new supplies and how to find them. Geology in one of its aspects is responsible for the fundamental knowledge which is necessary for the discovery of new deposits of oils and minerals. While it is easy to picture the coming period as the age of flight, where every American family will own its model T helicopter, it remains to be seen where the gasoline is to come from to lift the whole nation into the air and move it at great speed through the clouds. The planes can be built from plywood if necessary, but where the fuel is to be obtained—that is another question! No doubt geologists using refined methods of detection as improved by geophysicists will be able to discover new oil fields, but the process can not go on indefinitely, and some day this nation will have to use its shale deposits and rely on the synthetic fuels obtained by chemists from the hydrogenation of coal. Luckily there exist within the borders of the United States enormous deposits of low-grade coal, which by chemical methods may be made to yield fuels needed to replace the natural petroleum. The dream of an air-age must be scrutinized carefully on the basis of the fuel economy if it is not to be mere fantasy. As in the case of petroleum, the advances made by the physicists in the use of short-wave radio equipment may also help the mineralogist in the discovery of new deposits. However, such ore developments may happen in other regions of the globe, as yet not as well explored as the land-mass of this continent. Large deposits of high-grade iron ore are known to exist in South America. The oceans may have to step into the picture and furnish light metals as is now the case with magnesium. The American geologist has a serious task to perform if this nation is to maintain its preeminent position as an industrial power. In its more theroetical aspects as a branch of scientific learning, geology in its many divisions will make its contributions to the advancement of human thought in the post-war period as it has done in the past.

Turning now to the chemistry of to-morrow, it can be said that a similar vista of new and startling developments can be expected in the realm of chemical learning. No doubt chemists will continue their studies of the structure of molecules, they will obtain more satisfactory knowledge of reaction mechanisms, and they will make further progress along the present line of theoretical chemical thought. The impact of this advance in fundamental chemical information on the applied field will be indicated in the improvement which is expected in chemical technology. The time interval between the discovery of new scientific knowledge and its application in industry is ever being shortened and, furthermore, industrial research laboratories themselves are turning their attention to basic theoretical investigations in their own respective fields. This great mass of scientific learning will make it possible for American chemists to furnish to the economy of the nation the prerequisite power resources and materials needed by industry. The problem of substitutes will be ever more important, and synthetic rubber and plastics will have an even more significant role to play in the post-war period than they do now. A greater variety of artificial fibers such as rayon and nylon will be produced; new types of glassware like pyrex will be available; more powerful fuels will drive the engines of to-morrow, and the light metals, aluminum and magnesium, will find enormously greater industrial uses. The most spectacular and important progress, however, is predicted in the fields of biochemistry and chemotherapy. Every one now knows of sulfa-drugs and of penicillin. The latter is obtained from a lowly mold and has remarkable therapeutic value. No doubt chemists will isolate, analyze and synthesize the active substance, and make it available to the public at reasonable cost. Another newcomer is clavacin, from a different mold, which may be even more remarkable in its ability to kill bacteria than is penicillin. Vitamin research will continue, and in the field of immunization it may be expected that antibodies will be prepared in glass flasks instead of obtaining them from animals in the present tedious way. Advances in scientific knowledge will be made along all lines of scientific endeavor. It must be realized that the various fields of human learning are so complex and interrelated that progress in one goes hand in hand with advancement in another.

Newer concepts in mathematics make it possible for the physicist to evolve a new theory of the atom, which induces the chemist in turn to change his ideas of chemical combination. No natural scientist, be he biologist, botanist, physicist or chemist, can hope to keep abreast in his field of learning without a thorough knowledge of related topics and especially of mathematics. The queen of the sciences rules the domain of scientific learning, but for homage paid, she gives great return. No category of human thought affords greater satisfaction than the ability to state logical propositions in terms of mathematical symbols, and to arrive at exact conclusions by mathematical operations. Mathematics is the universal scientific language, and any nation neglecting this subject will lose its place in post-war competition. By the same token it is necessary to find those individuals of the younger generations who have the God-given aptitude to become the scientists of to-morrow, so that they may carry on the torch of scientific learning. Were it possible to settle the problems of mankind on a rational basis rather than on the present emotional plane, the world of to-morrow would be a better place to live in.

The scientist has hope. Even though he now looks upon a distorted world of victor and vanquished, he knows that real progress will be made, for in his imagination he sees a future which will be an improvement over the past.

In chapter twenty-one of Revelations it is written of the future of a new Jerusalem:

> And the building of the wall of it was of jasper, and the city was pure gold, like unto clear glass.
>
> And the foundations of the wall of the city were garnished with all manner of precious stones. The first foundation was jasper; the second, sapphire; the third chalcedony; the fourth an emerald; the fifth sardonyx; the sixth sardius; the seventh chrysolyte; the eighth beryl; the ninth a topaz; the tenth a chrysoprasus; the eleventh a jacinth; the twelfth an amethyst.
>
> And the twelve gates were twelve pearls; every several gate was of one pearl and the street of the city was of pure gold as it were transparent glass.

Should scientists accept these scriptures as a challenge? If not taken too literally, they have already done so.

An old Chinese philosopher has said of a gentleman: "To see clearly; to understand what he hears; to be warm in manner; dignified in bearing; faithful in speech; painstaking in his work; to ask when in doubt; in anger to think of difficulties; in sight of gain to think of right!"

All these qualities scientific men must possess and one more—imagination! With the ability of creative thought applied to their fields, scientists will transform the world!

OBITUARY

EDWARD BURR VAN VLECK

1863–1943

On June 2, 1943, a leading figure was plucked from the ranks of American scholars, and especially from those of American mathematicians, through the death of Edward Burr Van Vleck.

Professor Van Vleck was born at Middletown, Conn., on June 7, 1863, the son of John Munroe and Ellen Maria (Burr) Van Vleck. His college training he received at Wesleyan University, Conn., from which he graduated in 1884. His graduate studies in mathematics and physics he pursued at the Johns Hopkins University from 1884–87, and, after an interim during which he served as an instructor at his Alma Mater, at the University of Göttingen, Germany, from which he received the doctorate in 1893.

Professor Van Vleck's period of activity as a teacher and mathematical investigator may be regarded as having properly begun with his acceptance of an instructorship at the University of Wisconsin in 1893. Simultaneously with this he took membership in the American Mathematical Society, and thereby actively affiliated himself with that group of young scholars whose enthusiasm and attainments were largely instrumental in establishing in America mathematical standards and research comparable with those of Europe. Of this group he was one of the first to make his home in the Middle West. Although Wesleyan University again called him in 1895 and held him in a professorship until 1905, he thereupon returned to Wisconsin to spend there the remainder of his life. His retirement from active teaching came in 1929.

The development of American mathematics during the first quarter of the present century was phenomenal, and in this Professor Van Vleck played a prominent part. He become a member of the council of the American Mathematical Society in 1902, and was a "Colloquium Lecturer" before this society in 1903. He served the society from 1905–10 as an editor of its *Transactions*, in 1908 as its vice-president and during the years 1913–14 as its president. The mathematical literature over a period of many years is dotted with papers of his on infinite series; on functions defined by ordinary differential equations; on continued fractions; on point sets; on functional equations; on the roots of polynomials, etc. As a teacher he stood at all times for the highest standards of scholarly integrity. A considerable number of America's more accomplished contemporary mathematicians have at one time or another come under his influence.

Professor Van Vleck was the recipient of many honors. Aside from the offices through which the American Mathematical Society honored him, he was distinguished by Clark University (1909) and Wesleyan University (1925) as a doctor of laws; by the University of Groningen (1914) as a doctor of mathematics and physics; and by the University of Chicago (1916) as a doctor of science. The French government named him officier de l'instruction publique (1920); he became a member of the National Academy (1911); and he held the chairmanship of Section A of the American Association for the Advancement of Science (1912).

In his person Professor Van Vleck was modest and kindly. His father had been distinguished before him as a professor of astronomy and mathematics and erstwhile president at Wesleyan University. He thus carried on a family tradition of intellectual interest and culture. He was a passionate and experienced traveler, and made his home the repository of many artistic treasures.

Professor Van Vleck is survived by Mrs. Van Vleck (Hester Raymond) whom he married in 1893, who shared with him his many interests and who continues to make her home in Madison, Wis., and by his son, John Hasbrouck Van Vleck, professor of mathematics and physics at Harvard University.

Rudolph E. Langer

GEORGE WEST GRAVES

Dr. George West Graves, professor of agriculture and biology at Fresno State College, died in Fresno, Calif., on October 26, 1943. Professor Graves was born in Cedar Rapids, Iowa, on May 1, 1886. He is survived by his wife, the former Ella Macklin, and his parents, Walter Robert Graves and Mary Alice Graves.

His early education was received in the public schools of Chicago, Ill., where he graduated from the John Marshall High School. In 1905 he was graduated from Oberlin College. He received the Ph.B. from the University of Chicago in 1908. In 1912 he was awarded the M.S. by the State College of Washington. Further graduate study at the University of Southern California, the University of California and the University of Chicago led to the Ph.D. from the University of Chicago, 1931.

His interests were broad and enhanced by visits to England, Scotland, France, Belgium, Holland, Germany, Switzerland, Austria and Italy. In connection with his travels he studied the development of gardens at Kew, Pous, Berlin, Dresden and Amsterdam.

During the first World War he served as instructor in field artillery at Camp Taylor.

His more serious research interests were in the field of botany, where he made contributions on the ecological relationships of *Pinus sabiniana*. At the time of his demise he was actively participating in a study of fertilization in *Araucaria Bidwillii*.

In addition to serving as supervisor of agriculture in the public schools of Los Angeles, Professor Graves served as instructor in the State College of Washington, the University of Southern California and the University of California.

From September, 1919, until his demise, he served continuously as head of the department of agriculture and biology at Fresno State College. During this period of service he was successful in developing the largest department in that institution.

He played an active role in improving agricultural and science education in the San Joaquin Valley during the past twenty years, and was greatly interested in the development of science education throughout California. Since 1932 he contributed generously to the planning and preparation of the "Science Guide for Elementary Schools," a progressive enterprise of the California State Department of Education.

For the past sixteen years, Dr. Graves assumed the chief responsibility for the development of experimental gardens at the Fresno State College. As a token of appreciation, the administration of the college has taken steps to designate this enterprise in his memory as the George West Graves Botanical Gardens.

His general understanding of college problems had a tremendous influence in the development of the Fresno State College. His warm, friendly thoughts were generously shared with both students and colleagues, who quickly learned to seek his counsel. Always dealing with principles, never indulging in personalities, he will be remembered by those who were privileged to know him as a splendid teacher, a warm counselor and a sincere friend.

Leo F. Hadsall

Fresno State College

RECENT DEATHS

Dr. Louis J. Rettger, of Bedford Village, N. Y., from 1891 to 1937 professor of physiology and dean of Indiana State Teachers College and from 1931 to 1935 vice-president, died on December 1 at the age of seventy-six years.

Charles W. Mann, since 1922 senior pomologist at the Bureau of Plant Industry of the U. S. Department of Agriculture, died on December 3 at the age of sixty-four years. Mr. Mann was soil scientist with the Bureau of Soils from 1906 to 1910, assistant pomologist of the Bureau of Plant Industry, 1910–1917 and pomologist from 1919–1922, when he was appointed senior pomologist. He was a fellow of the American Association for the Advancement of Science.

Dr. William Salant, from 1908 to 1918 chief pharmacologist of the Bureau of Chemistry of the U. S. Department of Agriculture, died on December 10 at the age of seventy-three years. Dr. Salant became acting professor of physiological chemistry at the University of Wisconsin after leaving the Department of Agriculture, and from 1920 to 1929 was professor of physiology and pharmacology at the School of Medicine of the University of Georgia. He then became until his retirement in 1932 research pharmacologist of the biological laboratory at Cold Spring Harbor, L. I., N. Y.

Dr. Harold Stanard Adams, vice-president and plant manager of the Upjohn Company, manufacturing druggists, died on December 4 at the age of fifty-five years.

DR. QUICK LANDIS, research chemist at the Fleischmann Laboratories, Standard Brands, Incorporated, died on November 28 at the age of forty-two years.

SCIENTIFIC EVENTS

SCIENTIFIC AND TECHNOLOGICAL TRAINING IN GREAT BRITAIN

THE Parliamentary correspondent of *The Times*, London, reports that a motion, tabled in the House of Commons, by about one hundred members of Parliament of all parties urges the Government to take bold action to encourage scientific and technological training and to stimulate and coordinate research work of all kinds as an aid to post-war reconstruction policies. Most of the members who have signed the motion belong to the Parliamentary and Scientific Committee, of which the chairman is E. W. Salt, and many of them are members of the Tory Reform Committee. The sponsors of the motion are: Mr. Salt, Lord Hinchingbrooke, Dr. A. V. Hill, M. P. Price, Sir George Schuster and H. Graham White. The motion is as follows:

That this House, recognizing that if the United Kingdom is to maintain its position in the post-war world and carry out effective plans for physical reconstruction and social betterment, research and the application of scientific knowledge in all fields must be promoted on a far bolder scale than in the period 1919–39, urges his Majesty's Government forthwith:

(1) To assure the universities that in planning future developments for research, teaching, and higher learning as a whole they will receive support from the State on a much larger scale than hitherto.

(2) To arrange that education and training in schools, technical colleges, and universities shall be directed at the earliest date towards providing a far greater number of persons highly trained in science and technology.

(3) To set in motion schemes to ensure a substantial and coordinated expansion of research activity by private firms, cooperative industrial research associations, and State and other research establishments; and to this end, to provide assistance by adjustment of taxation, by more generous financial grants and through adequate priorities both in demobilization and for materials required for building and equipment.

RUBBER FROM RUSSIAN DANDELIONS

AN account of the work being done at Kew Gardens during the war was given on November 10 at the British Ministry of Agriculture by Sir Geoffrey Evans, economic botanist at Kew Gardens, who described, as reported in *The Times*, London, an experiment in the attempt to develop additional sources of rubber.

Seeds of three plants, from which rubber has of recent years been produced in Russia, were received at Kew and cultivated there and at 22 other stations. The plants were two kinds of dandelion—Kok-saghyz and Krim-saghyz—and a salsify, Tau-saghyz. The last was everywhere a failure, and Krim-saghyz proved rather delicate.

The most promising is Kok-saghyz, which comes from the Ukraine and Poland, and seems capable of giving as good results in Britain as in Russia—that is to say, a yield of perhaps 65 to 100 pounds of rubber to the acre, a figure which may be compared with 800 to 1,000 pounds an acre of Para rubber. These Russian dandelions contain from 2 per cent. to 17 per cent. of rubber in the dry root. No British native dandelion has been found to have more than 5 per cent. The rubber is found in the cells of the plant and can not be collected as with Para rubber from the latex or sap.

Kok-saghyz may be planted in the autumn and harvested the following August or it may be sown in the spring, and treated as an 18-month crop. The evidence is, however, that it needs good soil, and can not be grown on second-class land. Three or four crops sown in Scotland were poor.

The plant requires, moreover, a great deal of hand-weeding, which is extremely expensive. In Russia this is done by women and children on collective farms. The rubber is of reasonably good quality, but so far the authorities do not advise its general cultivation.

FINANCES OF THE UNIVERSITY OF ILLINOIS

ACCORDING to the annual financial report of Comptroller Lloyd Morey, in the seventy-five years since the University of Illinois began its educational and research activities, it has built and accumulated a plant and equipment worth $43,971,932. For the fiscal year, ending June 30, its income, including auxiliary enterprises, was $12,309,886, and the corresponding expenditures for all purposes were $11,893,878.

There are outstanding bonds in the amount of $2,233,800 on the Medical, Dental and Pharmacy Building in Chicago, and on four self-liquidating non-educational structures at Chicago and at Urbana.

The university has 2,383 acres of land, including the campus at Urbana-Champaign, the campus at Chicago, the agricultural experiment farms of 1,127 acres at Urbana-Champaign, and other farms comprising 700 acres in 24 counties; 74 major buildings and 70 others; utilities, equipment and a library containing 1,759,851 volumes, reprints, maps, etc., which make it the largest of any state university.

The portion of income used for educational and general purposes was $11,040,392, of which appropriations from state tax revenues provided $6,578,795 or 59.6 per cent. In the preceding year state taxes had provided $6,772,128 or 65.8 per cent.

The Federal Government supplied $2,356,149, while $1,258,710, or 11.4 per cent., came from student fees. Gifts from private sources amounted to $277,042, and sales of products and miscellaneous receipts to $569,-696. Under war-time contracts with the Federal Government for special training and research work the university expended $1,294,701 in the fiscal year ending on June 30. Contracts provide reimbursement by the Government of that amount.

The largest single war project of last year was the engineering, science and management war-training program, administered by the university in fifty-four war plant communities of Illinois, and for the training of 17,000 plant executives and specialists. On this project $367,567 was disbursed.

Other major war projects include research, Naval training schools for signalmen, diesel engine operators and diesel officers, and an Army specialized training and reassignment unit. The Army specialized training program and Navy V-12 college training program began in the month following the closing date of the comptroller's report on June 30.

THE WORLD MAP OF THE NATIONAL GEOGRAPHIC MAGAZINE

THE need for a world map in one piece has been filled by the last of five wall maps that have been published this year by the National Geographic Society. "The World Map" is issued with the *National Geographic Magazine* for December.

The 10-color chart is a continuous, panoramic picture of the world with the United States in the center. Distances to fighting fronts and America's relative position to the rest of the world are easily seen. The "ends of the earth" consist of an arbitrary line drawn across Asia from the tip of India to the Arctic mouth of the Yenisei River, Siberia.

The map is drawn to Van der Grinten's projection, which reduces the polar distortions of Mercator's projection. In order to show the polar regions in true perspective, the chart includes two upper corner insets centered at the Poles.

The map of the Northern and Southern Hemispheres issued last April and the map of the Eastern and Western Hemispheres issued in December, 1941, complement each other in showing the world from varied points of view.

Features of the new map are the two bottom corner insets of world maps giving the line-ups of belligerents in World Wars I and II. In both insets the physical preponderance of the Allies over Germany and her satellites is readily seen. The boundaries shown are as of the first day of war—September 1, 1939.

Included in the map are clock faces indicating local time when it is midnight in Greenwich; arrows showing the direction of sea currents; distinctive colors for colonial empires; icy blue coloration for glaciers and ice-cap; and native spellings of place names as well as the English equivalents. A table of the geographical equivalents used on the face of the map appears at the bottom of the sheet.

THE DR. WILLIAM BEAUMONT FOUNDATION

AT the first meeting of the Dr. William Beaumont Memorial Foundation in Prairie du Chien, on September 18, according to a report in the *Journal* of the Association of American Colleges, Dr. William D. Stovall, Madison, director of the State Laboratory of Hygiene, was elected chairman of the board of directors, and M. J. Dyrud, Prairie du Chien, was chosen president.

The foundation was incorporated in May and its purpose is to "perpetuate the name and memory of Dr. Beaumont and his memorable experiments in the physiology of digestion, and to recognize noteworthy contributions made by other physicians and surgeons of the United States." Organization of the foundation was planned and carried through by the Crawford County Medical Society and the local Kiwanis club. The officers include Dr. Olaf E. Satter, *vice-president,* Dr. Thomas F. Farrell, *treasurer,* and J. Alvin Dru'yor, *secretary.* Other members of the board of directors are Mayor F. W. Clanton, F. A. Otto and Paul H. Schmidt, all of Prairie du Chien. Dr. Walter J. Meek, acting dean of the Medical School of the University of Wisconsin, has been appointed chairman of the advisory board by the directors. Other appointments made were Cal Peters, curator; Dr. Peter L. Scanlan, Dr. Henry H. Kleinpell, Dr. John J. Kane, Dr. Charles A. Armstrong and Dr. Emil H. Lechtenberg, medical advisers to the curator, and Mr. Dyrud, general manager.

The first meeting of the new foundation was held in the hospital section of the second Fort Crawford, built in 1829, in which Dr. Beaumont served as post surgeon under Colonel Zachary Taylor, then commandant at the fort.

THE AMERICAN PHARMACEUTICAL MANUFACTURERS' ASSOCIATION

EACH year the American Pharmaceutical Manufacturers' Association presents an award of distinction to a scientific man who has made a fundamental contribution to public health in the field of drug therapy.

The mid-year meeting of the association was held at the Waldorf-Astoria, New York City, on December 13 and 14, when the annual scientific award was made jointly *in absentia* to Dr. Alexander Fleming, professor of bacteriology at the University of London, for his discovery of penicillin, and to Dr. Howard Walter Florey, professor of pathology at the University of Oxford, for his study of penicillin. The committee of award included Dr. George R. Cowgill, associate professor of physiological chemistry at the Medical School of Yale University, and Dr. Howard B. Lewis, professor of physiological chemistry and director of the College of Pharmacy of the University of Michigan.

Previous recipients of the medal are Dr. Nathan B. Eddy and Dr. Lyndon F. Small, for their studies of the chemistry, pharmacology and therapeutics of morphine derivatives; Dr. Perrin H. Long, for his study of the use of sulfanilamide, sulfapyridine and related pharmaceuticals in the treatment of disease; Dr. Tom D. Spies, for his contributions to our knowledge of the B-complex vitamins as pharmaceuticals important in the treatment of disease, and Dr. Edward A. Doisy, for his research in the hormone field.

The program on December 13, which was devoted to war medicine, included an introductory statement by Dr. Cowgill and addresses by Surgeon General Norman T. Kirk, U. S. Army, on "Army War Medicine"; by Acting Surgeon General Warren F. Draper, U. S. Public Health Service, on "Civilian War Medicine"; by Dr. Chester S. Keefer, professor of medicine at the School of Medicine of Boston University, on "The Research Physician in War Medicine"; by Dr. O. H. Perry Pepper, professor of medicine at the University of Pennsylvania School of Medicine, on "Medicine in War and After"; by Dr. Charles Thom, formerly principal mycologist of the U. S. Bureau of Plant Industry, on "Mold Research in War Medicine," and by Dr. George A. Harrop, director of the Squibb Institute for Medical Research, on "Pharmaceutical Development of War Medicine."

The program of the War Session on December 14 included addresses by Lieutenant Colonel Howard F. Currie, Commanding Officer, Army Medical Purchasing Office; Lieutenant Colonel Ralph R. Patch, chief of Production and Facilities Branch of the Procurement Division, Office of the Surgeon General, U. S. Army; Major E. P. Platt, chief of Contract Terminations and Surplus Property Section, Army Medical Purchasing Office; The Honorable Wendell Berge, Assistant U. S. Attorney General; Dr. Thomas A. McGoldrick, president of the New York State Medical Society; A. C. Nielsen, president of the A. C. Nielsen Company, and Charles Wesley Dunn, of the New York Bar.

SCIENTIFIC NOTES AND NEWS

The Remington Medal of the American Pharmaceutical Association was presented on December 7 at a dinner given by the New York Branch at the Hotel McAlpin to Dr. Robert P. Fischelis, chief of the Chemicals, Drugs and Health Supplies Branch of the Office of Civilian Requirements and pharmaceutical chemist of Trenton, N. J. The award was made in recognition of "his outstanding contributions to the profession of pharmacy" and for his "literary, scientific and organizational activities over a period of years." Dr. Curt P. Wimmer, associate dean of the College of Pharmacy of Columbia University, made the presentation. Dr. Fischelis is president of the New Jersey Pharmaceutical Association and secretary of the Board of Pharmacy of the State of New Jersey.

The American Mathematical Society at the recent annual meeting in Chicago awarded the Bocher Prize for the best original contribution to mathematical analysis published in an American mathematical periodical during the last five years to Dr. Jesse Douglas, assistant professor of mathematics at Brooklyn College. His articles were contributed to *The American Journal of Mathematics* in 1939 and to the *Transactions* of the American Mathematical Society in 1941.

A volume on mathematics in honor of Professor J. Rey Pastor is being published by Rosario University, Argentina. Invited contributors from the United States are Professor George D. Birkhoff, Harvard University; Professor Edward Kasner, Columbia University, and Dr. John DeCicco, the Illinois Institute of Technology.

Dr. Sanford A. Moss, of Lynn, Mass., known for his work on the development of the airplane turbo-supercharger for the General Electric Company, has been awarded the Sylvanus Albert Reed prize for 1943 by the Institute of the Aeronautical Sciences "in recognition of his notable contribution to aeronautical engineering." The award will be presented at the honors night dinner of the institute in New York on January 24. The Sylvanus Albert Reed Award was endowed in 1933 through a bequest of $10,000 by the late Dr. S. A. Reed and is given annually for outstanding achievements in the aeronautical sciences. It was awarded in 1942 to Igor I. Sikorsky, of the Sikorsky Aircraft Division of the United Aircraft Corporation.

At the Columbus meeting of entomologists Dr. Clarence E. Mickel, of the University of Minnesota, was elected president of the Entomological Society of America, and Professor E. O. Essig, of the University of California, was elected president of the American Association of Economic Entomologists.

Hubert M. Turner, associate professor of electrical engineering at Yale University, has been elected president of the Institute of Radio Engineers. He will take office at the first meeting of the year, which will be held in New York City on January 5.

The Society of the Sigma Xi, at its forty-fourth annual convention on December 4, in Chicago, elected Professor Ernest Carroll Faust, of the department of tropical medicine of the Medical School of Tulane University, a member of the executive committee. Dr. Lincoln T. Work, Metal and Thermit Corporation, Rahway, N. J., was elected a member of the committee on membership. Dean George B. Pegram, of Columbia University, was reelected treasurer, and Dr. George A. Baitsell, of Yale University, was reelected secretary. Dr. Harlow Shapley, director of Harvard College Observatory, continues as president of the society, since the term to which he was elected continues through next year.

William D. Ennis, Humphreys professor of the economics of engineering at the Stevens Institute of Technology, because of ill health will retire on March 1 with the title emeritus.

Dr. L. Everard Napier, for twenty years professor of tropical medicine at the Calcutta School of Tropical Medicine, is visiting professor of tropical medicine at the School of Medicine of Tulane University. He has also been appointed consultant on tropical medicine to the Secretary of War.

Dr. Charles Walter Clarke, executive director of the American Social Hygiene Association, New York, has been made clinical professor of public health practise at the Harvard Medical School.

Dr. Lowell T. Coggeshall, professor of epidemiology at the University of Michigan, has been appointed professor and chairman of the newly organized department of tropical diseases at the School of Public Health of the university. Hitherto tropical diseases have been included in the department of epidemiology, of which Dr. Thomas Francis, Jr., is chairman.

Dr. Harold C. Wiggers, assistant professor of physiology at the School of Medicine of Western Reserve University, has been appointed associate professor of physiology at the College of Medicine of the University of Illinois.

Dr. W. F. Cassie has been appointed to the chair of civil engineering at King's College, University of Durham.

Dr. William Bernard Robinson King, Woodwardian professor-elect of geology of the University of Cambridge, has been elected to a professorial fellowship at Magdalene College.

George F. Leonard, vice-president of Tobacco By-Products and Chemical Corporation, Louisville, Ky., has been elected *chairman* and Dr. Alfred Weed, vice-president of John Powell Company, New York, *secretary*, of the Agricultural Insecticide and Fungicide Industry Advisory Committee of the Office of Price Administration.

R. F. Hammatt, assistant to the chief of the U. S. Forest Service, has been appointed deputy national coordinator of the Office of Civilian Defense Forest Fire Fighters Service.

Colonel Paul Russell, of Washington, field director of the Rockefeller Foundation, has been appointed director of the first Allied overseas school for the study of malaria, which was opened on December 6 at the University of Algiers.

Dr. M. G. Van Campen has been promoted to be assistant scientific director of the research laboratories of the Wm. S. Merrell Company of Cincinnati, and Dr. Harold Werner has been appointed chief of the pharmacological division. Dr. Keith Wheeler recently joined the company as an organic research chemist.

Sir George Thomson, professor of physics at the Imperial College of Science, London, who received the Nobel Prize for physics in 1937, has been appointed scientific adviser to the British Air Ministry. He will be responsible for examining air operations from the scientific aspect, the methods, weapons and equipment employed, and for advising the Air Staff and other Air Ministry departments on these matters. On all questions affecting radio-communication and radiolocation he will work in consultation with Sir Robert Watson-Watt, scientific adviser on telecommunications.

The Committee of the Privy Council for Agricultural Research has appointed Lord De La Warr to be chairman of the Agricultural Research Council in succession to the late Sir Thomas Middleton. The committee has also appointed Professor I. de Burgh Daly, F.R.S., to be a member of the council in the place of Sir Joseph Barcroft, F.R.S., whose term of office has expired.

A. B. Winterbottom has joined the staff of the British Non-Ferrous Metals Research Association as a senior investigator. Mr. Winterbottom was carrying out independent research at the University of Norway (Trondheim), when Norway was invaded. He was recently repatriated after having undergone a period of detention in Germany.

Dr. William C. Black, professor of pathology at the School of Medicine of the University of Colorado, is now in Central America, taking one of the courses in tropical medicine given under the auspices of the Association of American Medical Colleges.

Dr. Stuart Mudd, professor of bacteriology at the Medical School of the University of Pennsylvania, lectured on December 2 at a meeting of the Theobald Smith Society. The lecture was entitled "Clues Regarding the Structure and Organization of the Simplest Living Systems."

Dr. Oscar Riddle delivered on December 1 a lecture in the Four College Genetic Series at Mount Holyoke College. He spoke on "Some Cases of Regulation by the Pituitary Gland."

Dr. C. C. Little, director of the Roscoe B. Jackson Memorial Laboratory at Bar Harbor, delivered on November 16 the fifth annual Barnard Hospital Lecture. The lecture was entitled "Parental Influence on the Incidence of Cancer."

Dr. Wallace E. Pratt, director of the Standard Oil Company of New Jersey, spoke on December 6 on "Future Supplies of Crude Oil" at a luncheon meeting of the Kappa Chapter of the Society of Sigma Xi of Columbia University.

The annual Nobel Prize dinner was held in New York City on December 10. The speakers included Professor Harold C. Urey, of Columbia University, who received the award for chemistry in 1932, and Professor Otto Meyerhoff, of the University of Pennsylvania, who received the award for physiology and medicine in 1922. Father Robert I. Gannon, president of Fordham University, presided, and Chancellor Harry Woodburn Chase, of New York University, was the chairman. More than half of the twenty-seven Nobel Prize laureates now in this country attended the dinner.

Speakers at the second War Conference on December 10 of the National Association of Manufacturers included Dr. Frank B. Jewett, president of the National Academy of Sciences; Dr. E. R. Weidlein, director, Mellon Institute of Industrial Research, Pittsburgh; Dr. A. R. Olpin, director, the Ohio State University Research Foundation; Lewis W. Waters, vice-president, General Foods Corporation; William C. Anthony, president, Anthony Company, Inc., Streator, Ill., and Dr. Gustav Egloff, president, American Institute of Chemists, and director of research, Universal Oil Products Corporation.

The two hundred and fifty-eighth meeting of the American Physical Society will be held at the California Institute of Technology, Pasadena, on December 27. There will be two sessions, starting at 9:30 A.M. and 1:30 P.M. The morning session will be held in Room 155, Arms Laboratory, and the afternoon session in the Norman Bridge Laboratory. Following six contributed papers at the morning session, two invited papers will be given by Professors Linus Pauling and F. Zwicky. The afternoon session will open with invited papers by Professor Alexander Goetz and Dr. Otto Boeck, and these will be followed by the remainder of the contributed papers.

The Field Museum of Natural History passed out of existence as a name on December 7, and the new name, Chicago Natural History Museum, went into effect officially with the granting of an amended state charter by the secretary of state at Springfield, according to an announcement made by Orr Goodson, acting director of the museum. The decision to change the name was announced in September by Stanley Field, president of the museum for the past thirty-five years, on the occasion of the celebration of the fiftieth anniversary of the institution's founding by the late Marshall Field. At that time President Field said: "The museum has had three names: Columbian Museum of Chicago—Field Columbian Museum—and Field Museum of Natural History. Mr. Marshall Field, III, has discussed with me several times the matter of the name of the museum. He has felt that since the museum was created and maintained for the public and has become identified in the minds of the public as a Chicago institution, and since it is now playing a growing and important part in the educational activities of the city—it would be appropriate, and also in the best interests of the museum, if the name were changed to the Chicago Natural History Museum, thereby identifying its ownership more closely with the people of Chicago, to whom, of course, it has always belonged."

DISCUSSION

STATISTICAL TREATMENT OF PERCENTAGE COUNTS

Many data in biology and agriculture are in the form of percentage counts. In entomology, especially, the percentage or proportion of a population affected by some condition is of importance, and in many other fields, data of this type occur. In such cases each individual of the population studied is recognized as either succeeding or failing in a given respect; it is dead or alive, parasitised or non-parasitized, male or female, etc. Where we have a number of individuals we can make a statement of the percentage in each class. The percentages, if determined repeatedly from the same population by random samples, fall in the "binomial distribution" of mathematicians. As a rule they must be determined from very moderate numbers. The question of how far we can go in applying standard statistical methods to them is continually being asked.

Tests using the chi-square distribution or direct calculation of probabilities are described in standard statistical texts (Snedecor,[1] Goulden[2] and others). In one form or another they answer the question as to whether two or more percentages could have been derived from the same population, or one could have been derived from a specified population. In many cases, however, percentages are each based on replicated experiments, as is needed for broad conclusions; and these tests have some limitations in such material, since we often get into somewhat different populations in our replication.

The application to such problems of the computed standard error of a difference or of analysis of variance requires assumptions which are not entirely fulfilled in enumerative data. However, with adequate numbers, and percentages in the range between 10 and 90, there is usually little trouble. While percentage counts are not exactly normal in distribution, they approach normality, and the mean of several will come nearer than any single one. The total number of those succeeding and also of those failing in the replications of a treatment must reach from 20 to 30 before this condition begins to be realized.

Variance among percentage counts is somewhat dependent on the mean, the part due strictly to random sampling being defined as pq/n.[3] However, between 10 and 90 per cent. the form of the relation does not lead to serious error in analysis of variance. Where extreme percentages must be compared, Bliss[4] has given us a transformation eliminating the correlation; it is tabled by Snedecor (Table 16.9). Percentages are replaced by their tabled functions, which are used in analysis and in drawing conclusions. Extreme percentages tend to be more symmetrical in distribution after the transformation, hence the requirement of 20 or more failing and succeeding may be relaxed a little with the transformation. However, it will not make feasible analysis where percentages in some classes are nearly all 0 or 100. The use of the method seldom gives conclusions much different from those from the use of unmodified percentages.

To be freely used, the percentages should be based on equal or nearly equal numbers. If base numbers for each determination are over 30 and do not vary widely, weighting will not give enough gain to be worthwhile.

The error estimate must include in some way the variance between tests at different times, which is usually larger than the theoretical minimum value pq/n, owing mostly to real variations in proportion in successive groups. Calculation of variance or standard deviation among successive percentage determinations and of the standard errors of means or of the mean difference, will follow well-known lines.

With several methods to be compared, analysis of variance may be applied. The form of analysis will follow the design of the experiment. Where each method is tested on several groups, differing from the groups used with the others, only the variance between and within methods will be determined. Where all are tested side by side on the same groups, the determination of variances between groups, between methods and for their interaction is possible. The interaction variance will function as error, and greater precision will be secured than in the first case.

As an example of possible treatment we can cite a comparison of percentage mortality among five insect groups treated with three compounds. Each percentage was determined from 100 insects. Results were as given in Table 1.

TABLE 1

Group No.	Compounds		
	A	B	C
1	25	52	77
2	38	67	82
3	27	48	69
4	30	70	74
5	31	58	78
Mean	30.2	59.0	76.0

The range of percentages, the base numbers and the total number surviving and dying in each treatment fulfil the requirements mentioned for comparisons by standard methods.

Here we may calculate the standard error of the mean difference between two compounds, taking advantage of the pairing, or carry out an analysis of the variance among two or more classes. We may even calculate from the latter analysis a standard error of the difference between any two means, if we are very careful to assure ourselves that it is representative.

On the other hand, consider a set of percentages of fruits attacked, based on 100 fruits each, under two treatments. With treatment A, the percentages are 6, 3, 2 and 5; with B, 7, 8, 5 and 11. The set under A fails in two respects in meeting the suggested standards; the percentages run well below 10 per cent. and the total number affected does not reach 20. With B, the total is over 20, but the percentages are still largely below 10 per cent. With a set based on only 25 individuals per unit, and percentages of 12, 16, 20 and 12, the standards are not met; while percentages are above

---

[1] G. W. Snedecor, "Statistical Methods," third edition, 1940.

[2] C. H. Goulden, "Methods of Statistical Analysis," 1939.

[3] Snedecor, l.c., Sec. 16.2.

[4] C. I. Bliss, *Ohio Jour. Sci.*, 38: 9–12, 1938.

10 per cent. the total number affected does not reach 20.

We may cite another hypothetical case, of four treatments with 3 replications each percentage based on 100 (Table 2).

TABLE 2

PERCENTAGE OF FRUITS ATTACKED

Replication	Treatment			
	A	B	C	D
1	6	2	1	4
2	59	55	46	60
3	66	48	36	54

This would fulfil in part the standards suggested, but the low values in one replication would make it seem desirable to employ Bliss's transformation. While the use of the transformation will not modify conclusions greatly, the results with the transformed data are somewhat more trustworthy, where very extreme percentages are mixed with intermediate ones.

In conclusion, it may be stated that the standard methods discussed have some limitations in application to enumeration data of the percentage count type. However, where percentages are based on adequate and similar numbers, where they are between 10 and 90 per cent, and where individuals succeeding and failing each total 20 or more in a treatment, these methods may be used. With more extreme percentages a transformation may be of help, and larger total numbers may be needed.

F. M. WADLEY

BUREAU OF ENTOMOLOGY AND
PLANT QUARANTINE,
U. S. DEPARTMENT OF AGRICULTURE

THE GERMINATION OF DORMANT LETTUCE SEED

IN improvement work with lettuce dormancy in freshly harvested seed often causes delays and loss of valuable seed. Workers have reported that light, high oxygen and high carbon dioxide concentrations aid in breaking dormancy. Thompson and Kosar[1] found that two ml of 0.5 per cent. thiourea in water markedly stimulated the germination of most of the lots of lettuce seed (*Lactuca sativa* L.) which they germinated on filter paper in 95-mm Petri dishes in darkness at 24° to 26° C.

In a preliminary attempt to germinate freshly harvested dormant seed of *L. serriola* L. two lots of seed were treated in thiourea as done by Thompson and Kosar,[1] and similar lots were handled in exactly the same manner except that they were kept in diffused light of about 150 foot candles. After 72 hours 98 per cent. of the seed in the light had germinated as compared with less than 1 per cent. of those in the dark.

In an attempt to evaluate the benefit derived from thiourea and from light three lots of strains of *L. sativa*, closely related to 456 and seven lots of *L. serriola* seed were treated with thiourea and with water both in darkness and in light. All seed had been harvested the previous day, but much of the *L. sativa* seed had been mature for a considerable time and had not been harvested because the plants were grown in a greenhouse and were protected from winds. The *L. serriola* seed were gathered in abandoned fields near Ithaca two days after a period of considerable wind that would have blown off seed that had matured before that time. Temperatures ranged between 21° and 28° C. Counts were made after 72 hours. Results are given in Table I.

TABLE I

Lot number	Thiourea		Water	
	Light	Darkness	Light	Darkness
Lactuca sativa				
1	100	96	10	16
2	100	76	0	4
3	100	96	4	6
Lactuca serriola				
1	96	4	6	0
2	94	44	4	0
3	78	10	16	0
4	64	0	2	0
5	56	0	4	0
6	72	0	8	0
7	72	20	10	0

As pointed out by Thompson and Kosar[1] thiourea markedly retards the growth of the seedlings. This retarding effect of thiourea can be largely eliminated without loss of stimulation of germination if the seed is treated with thiourea for 24 hours and then washed. This can be done conveniently by transferring the filter paper with the wet seed clinging to it to a Büchner funnel, washing well with distilled water and returning it to the rinsed Petri dish. Six lots of freshly harvested *L. serriola* seed treated in that manner varied in germination from 100 per cent. to 88 per cent. with an average of 94 per cent., while but one seed of the 300 of the 6 comparable lots moistened with water and left in the dark germinated.

In using this method for the growing of plants the treatment is started in the late afternoon so that the seed may have a maximum period of light following the night period when absorption of the thiourea solution may take place. Late the following afternoon the seed is washed with distilled water and returned to the Petri dish for planting the next morning in sand wet with dilute nutrient solution.

G. J. RALEIGH

DEPARTMENT OF VEGETABLE CROPS,
CORNELL UNIVERSITY

---

[1] Ross C. Thompson and William F. Kosar, *Plant Physiology*, 14: 567–573, 1939.

SOME MISLEADING TERMINOLOGIES IN THE LITERATURE OF "PLANT TISSUE CULTURE"

Most of the so-called tissues of the higher plants contain varying proportions of cells whose protoplasts are capable of division and subsequent growth. Under traumatic and other excessively abnormal influences, such protoplasts frequently proliferate and form callus, *e.g.*, in wound healing, in grafting, etc. Callus-like proliferations derived from excised parts of plants, when grown under controlled conditions *in vitro,* obviously provide extremely significant material for the experimental investigation of various morphological and physiological problems. It is misleading, however, to refer to such proliferations as cultures of a specific tissue even when the exact source of the callus is accurately known.

In the case of putative cultures of the cambium, not only is the callus entirely unlike the cambium in its cellular structure and its functional activities, but also there is no convincing evidence to indicate that the proliferations originated from the cambium.

The cambium consists of a layer of initials having a radial diameter of from 4 to 8 microns. It is flanked internally by elements of the xylem in varying stages of maturation and externally by elements of the phloem in varying stages of development. The parenchyma of the xylem and phloem commonly retains a capacity for cell division, as do tracheary elements, fibers and sieve cells during the earlier stages of their maturation. Even by using a microtome, it is unfortunately impossible to cut a tangential longitudinal section of a stem or root that consists entirely of living cambial initials. In the techniques employed by Gautheret,[1] White[2] and others, the bulk of the excised tissue, from which proliferations develop, consists of maturing xylem and phloem. In other words, there is no evidence to indicate that the callus originates solely from the cambium, rather than entirely or in part from its derivative tissues. Furthermore, the assumption that the bark of growing plants tends to split away from the wood along the cambium is entirely without justification. During the active growing season, the zone of excessive weakness lies well within the maturing xylem, *viz.*, in the region where tracheary elements have attained their maximum size, but haven't initiated the process of secondary wall formation. Thus, the cellular proliferations obtained on tangential surfaces that are exposed by pealing, splitting, tearing or cutting commonly do not originate from the cambium.

Until methods are perfected for actually isolating parts of meristems and for inducing them to grow without profoundly modifying their constituent cells, it is inadvisable to refer to abnormal proliferations obtained from heterogeneous bits of stems, roots or other organs as cultures of the cambium, procambium, cork cambium, etc.

I. W. Bailey

Biological Laboratories,
Harvard University

RELATIVE VALUES FOR DESCRIPTIVE WORDS

The interest in the uniform usage of words of indefinite meaning is probably not new. It is encouraging to note that recently several Science readers want to do something about it. One more suggestion may contribute to this interest and to a solution of the problem.

A numerical word has a definite value and wherever the figure appears it has the same value. For example, the figure 75 per cent. has an actual value and also indicates a value midway between half and total. But one statement that "oaks are common" has very little value when compared to another similar statement unless the value of the word "common" is rather definitely established. An observer may report that "the disease is prevalent in Brown County and common in White County." Without knowing the relative values of the words "prevalent" and "common," the reader can not learn from the report whether the disease is more, the same or less in Brown County compared to White County. To correct this situation, the relative values of such terms as "common" and "prevalent" should be established and used in such reports. With a standardized relative value, a word which ordinarily has an indefinite value may be used to convey a meaning about as definite as the condition on which the word is based.

It is proposed that a table of relative values be established for the use of a particular profession or a group of professions such as plant pathology, entomology, etc. A procedure similar to that employed in standardizing common names of trees or insects by a consensus of opinions might be used for this job. Of course, all individual opinions should yield to a consensus of opinions, and all reporters should adhere to the established relative values.

The relative values of a set of words could be based on an average or mean point and vary from that point to a maximum or minimum. For example, for such words as "abundant," "common" and "trace," indicating frequency of occurrence, the term "common" might be taken as the average or mean occurrence, "abundant" as the maximum frequency, and "trace" as the minimum amount. With this as a starting point such terms as "scarce," "light," "frequent," "prevalent," etc., could be given similar or in-between relative values. The same procedure could be used for words describing the health of a plant, so that such terms as "vigorous," "thrifty," "normal," "suppressed," etc., would have known relative values.

---

[1] R. J. Gautheret, *Rev. Cytol. et Cytophysiol. Vég.,* Paris, 1935.

[2] P. R. White, A Handbook of Plant Tissue Culture. Jaques Cattell Press. 1943.

Table 1 is presented as an illustration of how relative terms on these subjects may be arranged. There is no contention that all the terms in the table are appropriate to the subject or are properly placed. Such definite selection and placement must be based on a consensus of opinions.

TABLE 1

Abundant	Frequent many	Prevalent	Common normal average	Light scattered	Scarce few	Trace rare
luxuriant abundant	vigorous robust	strong thrifty good condition	normal healthy ordinary	declining suppressed impaired poor condition	sickly low vitality failing weak	dying deteriorating

If such relative values were established and used by all reporters on plant growth, for example, the readers would know that the terms "declining," "suppressed," "impaired" and "poor condition" indicate somewhat similar conditions. Furthermore, it would be known that the terms "sickly," "low vitality," "failing" and "weak" indicate a condition less favorable than that indicated by the above terms.

The writer will appreciate various opinions on this plan as well as suggestions on how it might be worked out. He is especially interested in learning how other writers would place the words used in the table. Examples of how descriptive words on other subjects might be arranged will be appreciated. If sufficient opinions are offered, the possibilities of arriving at a fair consensus of opinions may be indicated.

O. N. Liming

SCIENTIFIC BOOKS

NUTRITION

The Science of Nutrition. By Henry C. Sherman. xi + 253 pp. Columbia University Press. 1943. $2.75.

This book, written by a master in the field, is quite unique in its content. Not only does it attempt to present in a non-technical manner the general principles of nutrition, but the second half of the book is largely concerned with such chapters as "Are We Well Fed?," "The Nutritional Improvement of Life," "Nutrition for Realization of the Potentialities of Youth and of Maturity," "Nutritional Guidance for 'The Backward Art of Spending Money'" and "Nutrition Policy." It is concluded with a chapter dealing with "Scientific Critique of the 'Offer' of Higher Health and Longer Life." It is suggested in the preface that certain of the chapters which are heavy reading may be omitted without loss of understanding of the balance of the book; this may account for some amount of repetition.

The choice of title is unfortunate, for it is likely to be confused with the comprehensive text of the late Professor Graham Lusk of the same title. The treatise is logically written and well outlined; its manner of presentation should make it equally interesting to the trained nutritionist as well as to the uninitiated layman. The style and content are not sufficiently simple, however, to appeal to the uneducated man.

In discussing "Food as a fuel and body as a machine" (Chapter II), the author postulates that the excess of calories measured by direct calorimetry (0.25 per cent.) over those calculated by indirect calorimetry may be accounted for from the energy derived from light in causing an impulse in the optic nerve or resulting from the activation of vitamin D. However, from the reviewer's experience in this field, it would seem that the differences compiled by Armsby for experiments with dogs and herbivora (1,445,398 calories by direct; 1,441,691 calories by indirect) can best be explained as in the range of experimental error. As a criterion for overweight, Sherman cites the interesting case of Joe Louis, who, when in condition, would have been judged by ordinary standards too heavy for the Army or Navy. Specific gravity rather than absolute weight is a better measure and

> So by weighing him in water as well as in air, it was duly determined that Mr. Joe Louis was physically fit for service in the armed forces of the United States.

The historical discussion of the vitamins is especially well done. The author suggests that the layman should recognize "vitamine" as well as the present accepted spelling without the "e" and then proceeds to be inconsistent by spelling it both ways in later pages.

There is an interesting anecdote of the country doctor in the Virginia of the nineties who ordinarily made his rounds on horseback and who, like most people, was more or less troubled with rheumatism in the winter and spring. He ignored this until his joints became so sore that they troubled him in getting on his horse; "then he sucked lemons until the soreness of his joints went away." Later the author cites the work of Crandon and coworkers at the Harvard Medical School, where it was shown that a young adult may endure complete deprivation of vitamin C for long periods; it required two months before the ascorbic acid of the blood was reduced to zero, 134 days until clinical signs of scurvy were apparent, and more than five months (161 days) before distinct petechiae with retarded healing of an experimental wound were found. In the light of this information the recommendation on page 56 that,

> because of its labile nature . . ., we now believe it a good investment to include some significant source of this vitamin (C) in every meal, and to provide fruit or fruit juice instead of sweets if snacks are to be eaten between meals or before bedtime,

would seem to be very inconsistent and easily misunderstood by the laity.

One gets the impression that fortified oleomargarine is to be considered as an inferior fat to butter since the amount of vitamin A added approaches what may be considered "their share," which is "perhaps half as much as in good butter." The author neglects to explain that the level of 9,000 I.U. of vitamin A declared on the labels of various fortified margarines was set on the basis that this was the average vitamin A content of butters (good and poor). Unfortunately, the buyer has no way of knowing whether he is purchasing superior butter with 18,000 I.U. per pound or poor butter with 2,500 I.U. per pound.

In Chapter VIII on "How the Body Manages its Nutritional Resources" it is considered that one should not speak of bodily processes as mechanisms. Such *"isms"* are likely to become *"wasms,"* as W. M. Clarke earlier suggested was rapidly occurring with some scientific theories.

In Chapter IX on "The Nutritional Characteristics of the Chief Groups of Foods" the author has an interesting historical discussion on the milling of flour and emphasizes the importance of breadstuffs (especially from enriched flour) in our diets whereby as much as 38 per cent. of the calories, 37 per cent. of the protein and 30 per cent. of the phosphorus may be obtained by the expenditure of only 18 per cent. of the average budget for foods.

On the one hand, we are advised that nutritional deficiencies are much higher than is apparent from actuarial statistics due to non-recognition or mislabeling of the cause of death. "Our greatest nutritional handicap in the United States," it is stated, "is not that part of the population which is starving in the historic sense, nor that part which is *recognized* as suffering from specific nutritional deficiency diseases, but the part (probably much larger than those other parts put together) which 'is getting along on poor diets.'" On the other hand, we are later advised that the 1943 freshman class at Yale, although the youngest on record, is the tallest class in the history of that institution.

The last chapter is concerned largely with experimental evidence of the effect of diet on the rate of growth, on reproduction and on longevity. The author's experiments in this field are described in an interesting manner at some length. There is a selected bibliography of approximately 250 titles at the end.

When one has completed the book, there is a feeling that the information gained carries considerable authority.

H. J. DEUEL, JR.

UNIVERSITY OF SOUTHERN CALIFORNIA

AERIAL PHOTOGRAPHS

Aerial Photographs: Their Use and Interpretation. By A. J. EARDLEY. New York and London: Harper and Brothers. 203 + xxiv pp. Fully illustrated. $2.75.

THE aerial photograph is one of the most important implements of the war. It facilitates the construction of new maps and the revision of old ones. It provides the surest means of finding out about the enemy's defenses, the details of his communication systems, his industrial plants, his harbor installations and air fields, his troop, armor, matériel and ship movements. It provides the aerial bombardier with details of his targets and permits him to assess the damage caused by his bombing raids. In addition, the aerial photograph is an important implement of peace. Combined with some control from the ground, aerial photography permits the accurate survey of terrain which may range from a small parcel of real estate to large expanses of territory difficult of access on the ground. Its economic importance is already recognized and will grow rapidly. Vast studies have already been made of silting and soil erosion, of crop distribution and farm acreage, of timber growths, of geological features. Aerial photographs are used in surveys for laying oil pipe lines and power transmission lines, in water control and in many other important fields. In the days of untrammelled automobile traffic, they were even used for studying parking problems.

At the present time many people, both in the services and out, are learning to make or to interpret aerial photographs. A limited number of good texts are available to them for study. The present volume is a very good simple introduction to the subject in general, and an excellent treatise on the special study of geology by aerial photography. It has withstood the test of the classroom and laboratory.

The first third of the book treats of the taking of aerial photographs and their characteristics; there is a good introduction to the use of the stereoscope and plotting contours; and an introduction to making mosaics, including the radial line method of plotting.

The remainder of the book is concerned with the applications to geology, and a final chapter treats of tactical interpretation. It is a pioneering work in the geological field, and it is assumed that the student has had introductory courses in geology and elementary mineralogy and lithology. It should not be assumed, however, that it is only of use to the geologist, for geological structure determines other surface characteristics, and interpretation of the geological features shown in aerial photographs may be of much value for use in other fields. The strict geological interpretation is based on a thorough background of field geology, but a simple knowledge of geological characteristics is of help for general interpretation.

The man versed in the science of photogrammetry will find much lacking in the book. But it is not for him, and the selection of elementary material has been judiciously made and results in a good introduction to the interpretation of aerial photographs. It is to be expected that with the rapid changes going on in aerial photography, some sections, such as that dealing with apparatus, are somewhat out of date, but little is lost as a result. Not enough study has yet been made of infrared and color photography from the air to be able to state definitely that they are of importance, but one feels that some mention of the work already done in these fields should have been made. They show much promise. As in most books on this subject, one of the most important and fundamental aspects is but slightly touched, that is, the characteristics of photographic films and processing desirable for the production of negatives suitable for aerial photographic interpretation. It is far too easy to make a bad photograph—or, rather, we should perhaps say it requires much knowledge and experience to produce the best kind of photograph. Far too few people have that knowledge. It is to be hoped that the next edition of the book under review, which is otherwise very good, will include an authoritative chapter on the desirable photographic materials and their characteristics.

WALTER CLARK

SPECIAL ARTICLES

THE ANTIGENICITY OF PROTEIN ISOLATED FROM BOVINE SERUM AFTER BRIEF TREATMENT WITH ALKALI[1]

IN a recent publication, Lewis[2] states that "beef plasma which had been incubated one hour or longer with 0.5 normal sodium hydroxide and then neutralized was no longer antigenic when tested by gross anaphylaxis or by the more sensitive method using uterine strips from guinea pigs sensitized to native beef plasma." If we interpret this statement correctly, tests for antigenicity were carried out by using native plasma as the sensitizing antigen and alkali-treated protein as the shocking material. Apparently these results were interpreted to indicate a complete loss of antigenicity after treatment of the plasma with alkali. Obviously, however, it can not be decided from these data whether the results obtained were due to a change in antigenic specificity or to a loss of antigenicity. It has been our experience that protein isolated from bovine serum after exposure to 1 N alkali at room temperature for periods as long as 8 hours is still antigenic, although its antigenic specificity usually is altered by the alkaline treatment. Some of the data in support of our conclusions are included in this paper. A more detailed report will be published elsewhere at a later date.

The antigenicity of alkali-treated egg albumin,[3,4,5] horse serum,[6,7,8] zein,[5] edestin,[5] casein[5], and beef serum[8,9] has been studied by several investigators. In general, these studies have indicated that prolonged treatment with alkali will abolish antigenicity. However, Landsteiner and Barron[6] found that the protein isolated from horse serum treated with 1 N sodium hydroxide for 16 hours still gave weak complement fixation and precipitin reactions with homologous antiserum. Johnson and Wormall[7] reported similar results; treatment of horse serum at pH 13 or above for about 24 hours was required to abolish antigenicity.

Studies in these laboratories have indicated that the protein isolated from bovine serum treated with 1 N sodium hydroxide for 27 hours at room temperature apparently is non-antigenic.[9] The tests that have been employed for antigenicity include active anaphylaxis, passive anaphylaxis, complement fixation, and precipitin reactions. However, this material is not suitable for use in human therapy, since it is fatal to guinea pigs when given intravenously in doses of 35 mg per kg or larger. Lewis[2] stated that products prepared by treating bovine plasma with 0.5 N sodium hydroxide at 37° C. for periods longer than 8 hours were toxic when injected into guinea pigs, although such products were non-antigenic by the criteria employed.

---

[1] From the Departments of Immunochemistry and Biochemistry, Medical-Research Division, Sharp and Dohme, Inc., Glenolden, Pa.

[2] J. H. Lewis, SCIENCE, 98: 371, 1943.

[3] H. G. Wells, *Jour. Inf. Diseases*, 6: 506, 1909.

[4] C. Ten Broeck, *Jour. Biol. Chem.*, 17: 369, 1914.

[5] R. L. Kahn and A. McNeil, *Jour. Immunol.*, 3: 277, 1918.

[6] K. Landsteiner and C. Barron, *Zeits. Immunitätsf.*, 26: 142, 1917.

[7] L. R. Johnson and A. Wormall, *Biochem. Jour.*, 26: 1202, 1932.

[8] H. A. Davis and A. G. Eaton, *Proc. Soc. Exp. Biol. Med.*, 50: 246, 1942.

[9] L. E. Arnow, L. A. Kazal and R. J. DeFalco, *Jour. Biol. Chem.*, 146: 347, 1942.

We have tested also preparations isolated after treatment of bovine serum with 1 N sodium hydroxide at room temperature for periods of 1 hour, 2 hours, 4 hours and 8 hours. None of these preparations appeared to be toxic when administered intravenously to guinea pigs in doses as large as 300 mg per kg. The materials isolated after 1 hour and 2 hours (but not those isolated after 4 hours and 8 hours) gave weak precipitin tests with an antiserum prepared by injecting untreated bovine serum into rabbits. These same materials gave negative tests with other potent antisera prepared in the same way. However, we have been successful in preparing antisera to each of these 4 materials by intermittent intravenous injection into rabbits for periods of from 21 to 99 days. It is interesting that untreated bovine serum and all 4 of the alkali-treated materials gave positive precipitin tests with each of the antisera prepared with the alkali-treated proteins. Guinea pigs passively sensitized with antiserum prepared with protein isolated after treatment of serum for 2 hours with alkali were shocked with each of the other alkali-treated preparations (except the preparation treated for 1 hour, which was not tested) and with untreated bovine serum.

RALPH J. DEFALCO
LOUIS A. KAZAL
L. EARLE ARNOW

A PHYSICAL DEFICIENCY IN THE RATION OF RUMINANTS

THAT ruminants do not thrive on a ration limited to concentrates is well known. Several investigators have attempted to determine the deficiencies associated with such a diet.[1,2,3,4,5,6] Mead and his coworkers[4,5,6] found that calves could be carried through growth, pregnancy and lactation if cod-liver oil and calcium carbonate were added to a common concentrate mix. These animals could not, however, be considered normal, for it was necessary to limit their food consumption to avoid bloat. Despite precautions, four of the animals died of this cause. Johnson and his associates[7] fed calves a purified diet, adding Cellophane to make the ration more bulky. They state: "The growth rates of the 15 calves studied were below normal in most cases in comparison with Ragsdale's Standards. Poor food consumption associated with periodic digestive upsets seemed to be largely responsible for the slow growth."

As we have duplicated several of the symptoms observed on a diet of concentrates simply by fine grinding of roughage, it appears that a concentrate diet has physical as well as chemical or nutritive deficiencies. Several workers have considered that the mere lack of bulk might be a limiting factor in a concentrate diet for ruminants. The addition of soft bulky material such as paper pulp[6] or Cellophane[7] had, however, little beneficial effect. Rather, the limiting physical factor in a concentrate diet appears to be the absence of the coarse sharp material necessary to stimulate nerve fibers terminating in the ruminal mucosa. In experiments with cattle and sheep, finely ground alfalfa hay was compared with whole alfalfa, each being given in conjunction with concentrates. The concentrates and hay were fed in approximately equal proportions. The concentrate mixture consisted of rolled barley 60 per cent.; wheat bran 25 per cent.; soybean meal 12.5 per cent.; NaCl 2.5 per cent. The animals received all they would consume over a feeding period of approximately 8 hours. Since the chemical constituents of the two rations were the same, any discrepancies in response should depend upon the physical condition of the feed—whether ground or whole.

The following disorders were noted only when finely ground alfalfa was fed:

(1) Rumination occurred very irregularly or not at all. This is in line with the finding of Schalk and Amadon[8] that coarse material in the rumen stimulates rumination. Fine grinding so effectively breaks down the alfalfa stems that their irritating effect is largely lost.

(2) Bloat occurred frequently in cattle, but only once in a sheep. Twenty-one cases of bloat were encountered in 4 cows receiving the ground alfalfa hay over a 15-day period. This finding supports the postulate[9] that bloat results from a lack of sufficient coarse irritating roughage to induce the eructation reflex.

(3) Food consumption in cows was reduced as compared with consumption of whole alfalfa. This reduction amounted to 6.9 pounds daily per animal. The reduced consumption by cows receiving finely ground hay was largely due to the fact that, after consuming a large amount on one day, they were off-feed

---

[1] E. Davenport, *Ill. Agr. Exp. Sta. Bul.*, 46, 1897.

[2] A. C. McCandlish, *Jour. Dairy Sci.*, 6: 54, 1923.

[3] C. F. Huffman, *Mich. Exp. Sta. Quart. Bul.*, 11, No. 1, 1928.

[4] S. W. Mead and W. M. Regan, *Jour. Dairy Sci.*, 14: 283, 1931.

[5] S. W. Mead and H. Goss, *Jour. Dairy Sci.*, 18: 162, 1935.

[6] S. W. Mead and H. Goss, *Jour. Dairy Sci.*, 19: 465 (Abstract), 1936.

[7] P. E. Johnson, J. K. Loosli and L. A. Maynard, *Jour. Dairy Sci.*, 23: 553 (Abstract), 1940.

[8] A. F. Schalk and R. S. Amadon, *N. Dak. Agr. Exp. Sta. Bul.*, 216, 1928.

[9] H. H. Cole, S. W. Mead and M. Kleiber, *Calif. Agr. Exp. Sta. Bul.* 662, 1942.

the next. This experience agrees with that reported by Johnson and his co-workers for calves on purified diets. As Mead and Goss[6] limited food consumption to avoid bloat, they had no critical measure of the appetites of their animals. In ewes this difference in food consumption was not manifest.

(4) The animals had depraved appetites, manifested by wood chewing. This condition was observed in both ruminants and was not evident when finely ground alfalfa was replaced by whole alfalfa. Although others[2, 10] have observed this phenomenon when ruminants were limited to concentrates, it has not been attributed previously to the physical nature of the diet. Since the animals were fed all they would consume, hunger in the usual sense of the term was not involved.

The lack of coarse material in the diet appeared to produce more pronounced symptoms in cattle than in sheep. Possibly, then, the former require coarser feeds. As is well known, cattle consume coarse, stemmy roughages more readily.

These results show that a physical deficiency, a lack of coarse irritating material in the rumen, in the ration of ruminants results in the following syndrome: failure of, or diminished, rumination; difficulty in eructation, often causing tympany or bloat, especially in cattle; reduction in food consumption in cattle; and depraved appetite, as manifested by wood chewing.

H. H. COLE
S. W. MEAD

DIVISION OF ANIMAL HUSBANDRY,
UNIVERSITY OF CALIFORNIA,
DAVIS

THE CULTURE OF YOUNG CONIFER EMBRYOS IN VITRO

CULTURE of embryos *in vitro* has been made by many workers in the past, the more important works on the subject are those of Dietrich,[1] Li,[2] LaRue,[3] Tukey,[4] Bonner,[5] Solacolu, *et al.*[6] and van Overbeek, *et al.*[7] The materials used by these workers are mature or immature plant embryos which had already attained considerable size. As far as we are aware, no successful attempt has been made to culture very young embryos of one to several cells in size. The present account is a preliminary report of our work, which is being continued, on the culture of isolated conifer embryos when the latter are only at the one- or several-cell stage.

Embryos of pine (*Pinus yunnanensis*) and Keteleeria (*K. Davidiana*) were dissected out from the ovules and transferred to culture media in Petri dishes under asceptic conditions. The medium used is a modified Pfeffer's solution[8] containing 2 per cent. sucrose and 0.6 per cent. agar. To this "standard" medium (SM) was added various growth substances (heteroauxin, 10 mg per liter; thiamin, 0.1 mg per liter; ascorbic acid, 10 mg. per liter; nicotinic acid, 1 mg per liter or vitamin B_6, 0.1 mg per liter).

Young embryos[9] of pine were inoculated on agar media containing SM and SM and added growth substances on June 11, 1942. After two weeks, the one- to several-celled embryos grown on SM had less than ten cells, while that grown on SM plus indol-acetic acid developed into an embryo of several hundred cells in size, and that grown on SM plus thiamin attained a size of about one hundred cells. Later observations, made on and after July 29, revealed but little growth in any of the cultures.

Keteleeria embryos were cultured in the same manner on July 7. In one of the cultures containing SM plus indol-acetic acid and thiamin a 2-celled embryo of 60 × 40 µ became a 12-celled embryo of 156 × 117 µ ten days later, and this developed into a multicelled embryo of 608 × 156 µ on July 25. Although young embryos of Keteleeria can develop somewhat on all the media used, none of these can approach SM with indol-acetic acid and thiamin as a favorable medium for the growth and development of Keteleeria embryos.

Further work on this problem is necessarily postponed due to seasonal limitations, but these preliminary experiments indicate that it is probable that conifer embryos of one to several cells in size can grow and develop normally *in vitro* in the presence of heteroauxin and thiamin, at least for a certain length of time. It is possible that they may even be grown to maturity *in vitro* with medium containing other growth factors in addition to heteroauxin and thiamin.

S. W. LOO[10]
F. H. WANG

DEPARTMENT OF BIOLOGY, NATIONAL UNIVERSITY
OF PEKING, AND PHYSIOLOGICAL LABORATORY,
NATIONAL TSING HUA UNIVERSITY, KUNMING,
CHINA

---

[10] L. L. Madsen, C. M. McKay and L. A. Maynard, *Cornell Univ. Agr. Exp. Sta. Mem.* 178, 1935.

[1] K. Dietrich, *Flora N. F.*, 17: 379, 1924.

[2] T. T. Li, *Sci. Rept. Nat. Tsing Hua Univ.*, Ser. B. 2: 29, 1934.

[3] C. D. LaRue, *Am. Jour. Bot.*, 22: 914, 1935; *Bull. Torrey Bot. Club*, 63: 365, 1936, and 65: 11, 1938.

[4] H. B. Tukey, *Jour. Hered.*, 24: 1, 1933; *Am. Soc. Hort. Sci.*, 32: 313, 1934; *Bot. Gaz.*, 99: 630, 1938.

[5] J. Bonner, *Plant Physiol.*, 13: 865, 1938; *Proc. Nat. Acad. Sci.*, 24: 70, 1938.

[6] T. Solacolu, *et al.*, *Compt. Rend. Soc. Biol.*, 129: 403, 1938.

[7] J. van Overbeek, *et al.*, SCIENCE, 94: 2441, 350, 1941.

[8] One liter of this solution contains: $Ca(NO_3)_2$, 328 mg; KNO_3, 80 mg; $MgSO_4 \cdot 7\,H_2O$, 98 mg; KH_2SO_4, 18 mg; KCl, 74 mg; $FeCl_3$, 1.6 mg.

[9] Young embryos of pine undergo cleavage soon after the elongation of their suspensors, so that each embryo is split into four single-celled embryos.

[10] Present address: Kerckhoff Laboratories of the Biological Sciences, California Institute of Technology, Pasadena, Calif.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

HEMATOCRIT DETERMINATION OF RELATIVE CELL VOLUME[1]

The determination of the volume of erythrocytes and similar free cells relative to their suspending fluid may be carried out rapidly and with high precision. A number of types of hematocrit tubes have been described, all of which are adapted to low centrifugal forces. Adequate packing of red cells with complete expression of the supernatant fluid requires high forces. We have found thin-walled, capillary tubing (o.d. 0.5 mm, i.d. 0.35 mm) used in conjunction with an air turbine of the type used by Beams[2] a most satisfactory answer to this problem. The capillary tubing must have a uniform bore.

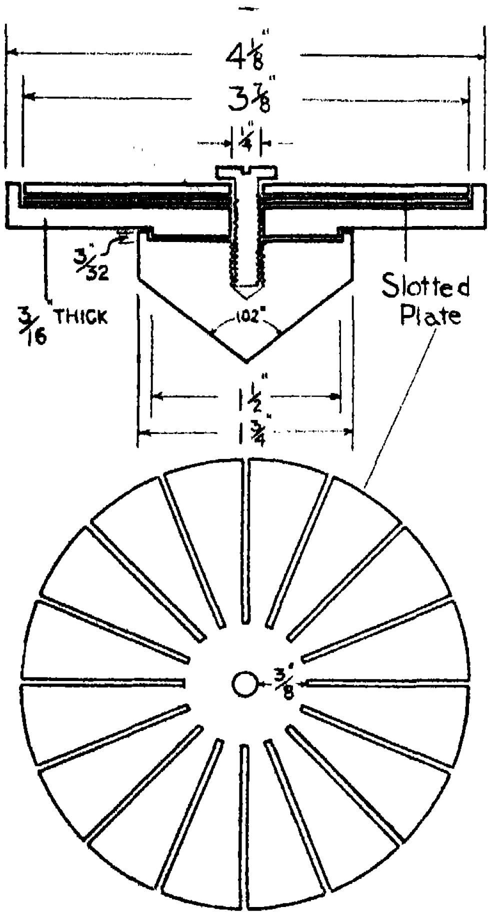


Fig. 1

In detail the method involves allowing well-mixed blood to be drawn by capillarity into capillary tubes 3 cms in length to within 0.5 cms from one end. This latter end is quickly sealed in a small oxygen-gas flame, care being taken not to heat the blood. After brief practice at such sealing it is possible to seal the tube so that the internal bottom of the tube is approximately flat.

These filled, sealed tubes are put into the slots of the flat disc rotor shown in Fig. 1, and centrifuged for five minutes at a force of ca. 30,000 × G. This force and time of centrifuging was found to give practically complete packing of the red cells in freshly collected blood with a standard deviation of the red cell total volume of 0.34 per cent. This fact is based on experimental studies which have shown that at all forces between 20,000 and 190,000 × G, the degree of packing of red cells is approaching an asymptotic value which is 1.7 per cent. less than the packing obtained at the lower force. Between 40,000 × G and 190,000 × G the red cell volume drops only 0.7 per cent.

Studies on blood with varying degrees of hemolysis have shown that the relative volume of the intact cells can be determined by this method with a standard deviation of 0.84 per cent. This value does not include 3 deviations which were 3.7 σ, 5.9 σ and 6.2 σ; and is based on 106 determinations. The degree of hemolysis varied from 1 to 43 per cent.

Red cells which have been packed by this method can be resuspended and repacked three times without showing any change in the length of the cell column. This indicates that packing at high forces does not cause any rupture of the cells.

Readings on the length of the cell column and of the total column are made under a dissecting microscope against a standard steel rule engraved in 0.5 mm divisions. At the higher centrifugal forces short (1 cm) tubes are used. Their cell and total column length are measured under the microscope with a Filar Ocular Micrometer. Such readings can be reproduced with a standard deviation of 0.14 per cent. If longer times of centrifuging are required then these tubes must be sealed at both ends to check evaporation. Care must be taken to place the hematocrit tubes in the vertical position as soon after centrifuging as possible.

A. K. Parpart
R. Ballentine

Physiological Laboratory,
Princeton University

---

[1] The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Princeton University.

[2] J. W. Beams, Science, 74: 44, 1931.

SIMPLE ADAPTERS FOR CONTINUOUS EXTRACTION OF AQUEOUS SOLUTIONS IN THE SOXHLET EXTRACTOR

The problem of the continuous extraction of aqueous solutions by immiscible solvents is one that presents itself quite frequently. While many devices have been described for just this purpose, the construction of most, if not all, requires an expert glassblower. Most laboratories are equipped with, or can readily obtain, a Soxhlet-type extractor. The present communication describes two simple adapters which have been found extremely useful in this laboratory which extend the versatility of the Soxhlet extractor to include the extraction of aqueous solutions by immiscible solvents heavier or lighter than water. Both can be assembled by almost any laboratory worker.

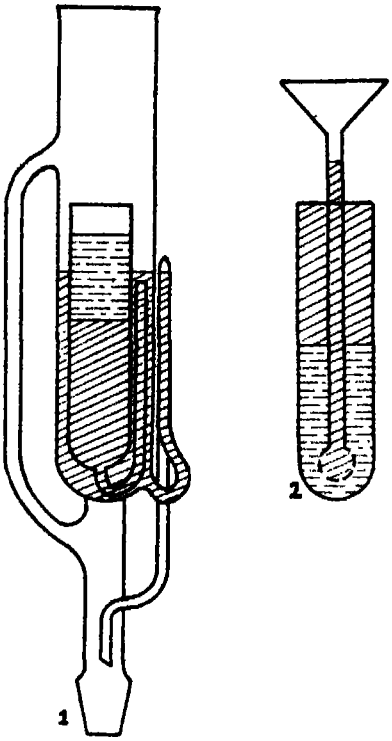


Fig. 1. Soxhlet apparatus equipped with an adapter for extraction of aqueous solutions with solvents heavier than water. The solvent is indicated by the sloping lines.
Fig. 2. An adapter for the extraction of aqueous solutions with solvents lighter than water. The solvent is indicated by sloping lines.

Fig. 1 shows the Soxhlet extractor equipped with an adapter for the extraction of an aqueous solution with a heavy solvent such as chloroform. The adapter is constructed by sealing a length of glass tubing to the bottom of a test-tube of the desired width and then bending it around as described in the figure. The height of the bent outlet tube should be less than that of the body of the adapter. It need not be higher than the siphon of the Soxhlet extractor. To carry out such an extraction the heavy solvent is first introduced into the adapter to about the half-way mark and then the solution to be extracted is layered on top of this until the solvent comes out of the outlet side tube. The apparatus is now ready for use as in a regular Soxhlet extraction. When the chloroform which has condensed, percolated through the aqueous solution and has been forced out through the side arm reaches the level of the siphon it is returned to the extraction flask.

Fig. 2 illustrates an adapter for extraction with solvents lighter than water. This consists of a tube or vessel of any convenient height, depending on the amount of solution to be extracted, which will fit into the body of the Soxhlet extractor. The tube is equipped with a funnel whose diameter is slightly smaller than that of the extractor. For extraction the solution is introduced into the tube or vessel and the funnel is inserted. Extraction is now carried out as in the usual Soxhlet extraction. The condensing solvent drops through the funnel and percolates up through the solution. When the height of the solvent in the Soxhlet reaches that of the siphon it is returned to the extraction flask. The height of the vessel can be greater or less than the height of the siphon and is therefore adaptable for the extraction of small amounts of solution. For more effective extraction the funnel may be equipped with a perforated glass bulb in order better to distribute the solvent through the solution.

The adapters can be used in micro Soxhlet extraction apparatus as well as in the usual laboratory size apparatus.

Bernard S. Gould

Department of Biology and
Biological Engineering,
Massachusetts Institute
of Technology

BOOKS RECEIVED

Erdtman, G. *An Introduction to Pollen Analysis.* Illustrated. Pp. xv + 239. Chronica Botanica. $5.00.

Hougen, Olaf A. and Kenneth M. Watson. *Chemical Process Principles. Part One: Material and Energy Balances.* Illustrated. Pp. xii + 452. John Wiley and Sons. $4.50.

Kern, Willis F. and James R. Bland. *Geometry with Military and Naval Applications.* Illustrated. Pp. vii + 152. John Wiley and Sons. $1.75.

Powers, Paul O. *Synthetic Resins and Rubbers.* Illustrated. Pp. v + 296. John Wiley and Sons. $3.00.

Read, William Thornton. *Industrial Chemistry.* Illustrated. Pp. v + 631. John Wiley and Sons. $5.00.

Shapley, Harlow. *Galaxies.* Illustrated. Pp. vii + 229. The Blakiston Company. $2.50.

SCIENCE

VOL. 98 FRIDAY, DECEMBER 24, 1943 No. 2556

The Return of the Pulmotor As a "Resuscitator":
PROFESSOR YANDELL HENDERSON ... 547

The Cincinnati Observatory:
The Centenary of the Observatory: DR. RAYMOND WALTERS ... 551
Ormsby MacKnight Mitchel, Cleveland Abbe: DR. EVERETT I. YOWELL ... 553

Obituary:
Deaths and Memorials ... 555

Scientific Events:
The Post-War Forestry Policy of Great Britain; The Research Council on Problems of Alcohol; Reorganization of the Public Health Service; National Research Council Grants for Research in Endocrinology; Andreas Vesalius ... 555
Scientific Notes and News ... 557

Discussion:
Confusion over Glacial Lake Spokane: THOMAS LARGE. *Early Hydrographic Work on an American Lake:* DR. JOHN W. WELLS. *Pre-Tennysonian Thoughts on Air Transportation:* DR. WILLIAM H. CREW ... 560

Scientific Books:
Plants and Vitamins: DR. PAUL R. BURKHOLDER 563

Reports:
A Department of Geography ... 564

Special Articles:
Serological Reactions with an Indifferent Streptococcus in Primary Atypical Pneumonia: DR. FRANK L. HORSFALL, JR. and OTHERS. *The Adrenals and Susceptibility to Transplanted Leukemia of Rats:* DR. JAMES B. MURPHY and ERNEST STURM. *Low Light Intensity and Cotton Boll-Shedding:* DR. A. A. DUNLAP ... 566

Scientific Apparatus and Laboratory Methods:
Use of Enzymes to Improve Cytological Techniques: DR. NEIL W. STUART and DR. S. L. EMSWEILER. *A Nylon Blood and Plasma Filter:* DR. ELIZABETH B. GLASER ... 569
Science News ... 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

THE RETURN OF THE PULMOTOR AS A "RESUSCITATOR": A BACK-STEP TOWARD THE DEATH OF THOUSANDS[1]

By Professor YANDELL HENDERSON

YALE UNIVERSITY

IN no field of scientific activity during the past half century have the advances been greater than in that concerned with the saving of human lives. Yet along with some of these advances there have been very considerable amounts of charlatanism; quackery and their inevitable consequence—increase of mortality. Fortunately what was false and harmful has generally been, after a time, exposed and rejected; but not always or soon. And now a particularly evil affair has developed: that of a device that thirty years ago was introduced as a life-saver, but that was shown to be rather a life-loser, and was therefore rejected; yet that now is again being exploited under another name with all the force of high-powered salesmanship and pseudoscience to the inevitable loss of many lives that could be, and should be, saved.

The device to which I refer is a breathing machine that at first was called a "pulmotor" and that now, slightly changed in form but identical in essentials, is being reintroduced under another name as a "resuscitator." By alternately sucking and blowing, these "pulmotor-resuscitators" were designed, and have been claimed, to remove poisonous gases from the lungs and blood and to induce a return of breathing in cases of partial drowning, electric shock and gas asphyxiation. For this claim, no valid scientific evidence has ever been offered. The sole supporting argument for such suck and blow devices is a demonstration that, when one of them is attached to a rubber bag, the bag can be alternately inflated and deflated; and—more dramatically—that when an inflated rubber doll is substituted for the bag, the doll can be made to "breathe" realistically. On this basis, the claim is that, if the human lungs were similarly subjected to alternating positive and negative pressures, they would be similarly ventilated. Yet in reality they are not, unless the positive and negative pressures employed are so large as to induce mechanical injury, dangerous degrees of acapnia and failure of the circulation.

---

[1] For the evidence, experimental and clinical, and full references to the literature upon which this article is based, see: Henderson and Haggard, "Noxious Gases and the Principles of Respiration Influencing Their Action," 2d edition, New York, 1943; Henderson and Turner, "Artificial Respiration and Inhalation," *Jour. Am. Med. Asn.*, 116: 1508, 1941; Henderson, "Adventures in Respiration; Modes of Asphyxiation and Methods of Resuscitation," Baltimore, 1938; and same author, "Tonus and the Venopressor Mechanism: The Clinical Physiology of a Major Mode of Death," *Medicine*, 22: 223, September, 1943.

It is true that a healthy conscious man can voluntarily adjust his breathing to the rhythm of such apparatus, so that he appears to behave like the rubber doll. But if the patient is unconscious and the pressures applied, both positive and negative, are low enough to be harmless, there is generally either complete discordance between the patient's breathing and the rhythm of the apparatus; or else the well-known vagal reflexes from the lungs—which are lacking in a rubber doll—cause the diaphragm to resist the artificial respiration by contrary respiratory movements.

The inventors of the pulmotor assumed, and the promotors of "resuscitators" still claim, that by artificially forcing the lungs and chest through movements like those of breathing, a return of natural respiration should be induced. But, on the contrary, the far-reaching advances made during the past four decades in our knowledge of the physiological control and regulation of respiration have established the facts that the restoration and maintenance of respiration are principally dependent, not on the reciprocating reflexes of inspiration and expiration, but on the chemical stimulation of the respiratory center in the brain by the blood gases—particularly carbon dioxide, along with an adequate amount of oxygen. The argument for pulmotors and "resuscitators" implied by the rubber doll is that, just as a stalled gasoline motor in an automobile or motor boat can be restarted by cranking, so by analogous means a drowned or asphyxiated man, or an apneic newborn baby, should be resuscitated: which is in direct conflict with all that is known scientifically about resuscitation.

My own experience with carbon monoxide asphyxia began in 1910 when I was called to see a man who had been overcome in his bedroom by city gas and was under treatment with a pulmotor. He was not very deeply asphyxiated; but he was entirely unconscious and was breathing stertorously. What was most noticeable was that the rhythm of the apparatus was entirely out of step with the patient's own respiration, which it was rather opposing and impeding than aiding. However, in that case, consciousness returned after a time, as occurs in mild cases without any treatment; and recovery followed. Now, after the experience of thirty-two years and hundreds of cases far more efficiently treated, I can report a recent similar victim, not treated by me, who also was still breathing while a "resuscitator" clicked rapidly and ineffectively from blowing to sucking and sucking to blowing, wholly out of time and in conflict with the patient's own respiration. In that case, consciousness did not return, and the man died in coma a couple of days after the asphyxiation.

CARBON MONOXIDE ASPHYXIA

Unlike many other poisonous gases, carbon monoxide is not an irritant: even in amounts that are deadly, it does not directly injure the lungs, and may not appreciably diminish the percentage of oxygen in the air of the lungs. Instead, this gas combines with the hemoglobin, the red coloring matter and oxygen-carrying substance in the blood. Until it is largely displaced from the blood and the oxygen-carrying capacity of the blood thus restored, the tissues of the body, and particularly the brain, continue in a state of asphyxiation, that is, oxygen starvation. Accordingly, it was early realized that the only way that carbon monoxide can be displaced from hemoglobin is by the mass action of oxygen. But in practice, mere inhalation of oxygen alone often failed to resuscitate; and if the victims did not die in asphyxia, they sometimes survived as idiots or neurological cripples.

If then asphyxial damage to the brain is to be reduced to a minimum, it is essential that as large an amount of oxygen as possible shall be drawn into the lungs, and blown out again several times a minute for a half hour or more with continually fresh oxygen. This—as above stated—pulmotors and "resuscitators" were designed to do; but, owing to the fact that natural respiration will not cooperate with sucking and blowing machines, but rather opposes their action, they have proved incapable of accomplishing. Accordingly, the mortality induced by carbon monoxide poisoning in such cities as New York and Chicago—during what may be called the "pulmotor period" (1910–1922)—was not appreciably decreased from the "prepulmotor or oxygen inhalation period" (prior to 1910). A typical case of the deaths that were common in the "pulmotor period" was described in the *Journal* of the American Medical Association of March 8, 1912, page 738, by a competent witness, Dr. Morris Fishbein, now the editor of that journal, as follows: The patient "who had been poisoned with CO was subjected to the action of a pulmotor for several hours. After nearly 5 days of unconsciousness, the patient died. At autopsy, hemorrhage into the lungs and visceral pleural emphysema (dilated areas) of the right lung were found, together with subpleural emphysema." In this and many similar cases it is particularly noteworthy that, as carbon monoxide is not an irritant gas, the condition of the lungs found at autopsy was clearly due mainly to the mechanical damage done by the sucking and blowing of the apparatus.

In the directions for the use of "resuscitators," which are supplied with the apparatus, it is stated that, if the patient is still breathing, or begins to breathe, the suck and blow action should be switched off and the inhalational action switched on. And this, little as the writers of those directions seem to realize it, virtually signs the death warrant of every deeply asphyxiated patient so treated. For this inhalation is given with a type of mask and valves such that much of the carbon monoxide that comes out of the lungs is re-inhaled and its elimination thus retarded. Neither in respect to artificial respiration by sucking and blowing nor by means of their inadequate inhalational attachment are the "resuscitators," now so actively promoted, capable of restoring natural breathing or eliminating carbon monoxide from the lungs and blood sufficiently rapidly, if the case is severe, to prevent serious and even fatal postasphyxial effects.

RESUSCITATION BY INHALATION OF CARBON DIOXIDE AND OXYGEN

Fortunately for the saving of life, that volume of lung ventilation which can not be produced by suck and blow machinery, without risk of serious harm, can be induced safely and with high efficiency by natural breathing when stimulated by inhalation of carbon dioxide. For when the requisite concentration (7 to 9 per cent.) of carbon dioxide is administered mixed with otherwise pure oxygen, so large a volume of breathing is induced and such a mass action of oxygen is brought to bear on the blood as it flows through the lungs that virtually all the carbon monoxide that has been absorbed is rapidly eliminated; and the asphxiation is thereby terminated.

Accordingly, in 1921, Henderson and Haggard introduced the method *of resuscitation by inhalation of* oxygen with enough carbon dioxide to induce a maximum minute-volume of respiration. After long and careful laboratory and clinical tests, they determined the conditions requisite for the most effective use of this mixture. These are (1) that it shall contain 7 to 9 per cent. of the stimulant carbon dioxide; (2) that the inhalator employed shall be capable of administering the maximum volume per minute that the patient can thus be stimulated to inhale; (3) that the inhalator shall not permit any rebreathing whatever; and (4) that the valves and bag shall be so arranged that the resuscitant gas flows to the mask only during inspiration; otherwise the supply may be exhausted before resuscitation is effected.

It should be emphasized also that the inhalator devised along these lines by Henderson and Haggard has never been patented, or its manufacture, sale and use limited in any way; it is free to any and all.

MANUAL VERSUS MECHANICAL ARTIFICIAL RESPIRATION

At nearly the same time (about 1912) that the pulmotor first appeared, the prone pressure method of manual artificial respiration was introduced by Professor E. A. Schafer, of Edinburgh. In order that there might be sound and authoritative evaluation of all methods, new and old, for artificial respiration, a Committee on Resuscitation from Mine Gases was appointed jointly by the U. S. Bureau of Mines, the American Medical Association, the American Red Cross and the National Electric Light Association; the predecessor of the Edison Institute. The members of this committee were W. B. Cannon, G. W. Crile, J. Erlanger, S. J. Meltzer and Y. Henderson; and as authorities on the conditions inducing death by electric shock, Elihu Thomson and A. E. Kennelly were added. All methods of artificial respiration known or proposed at that time (1912) were subjected to careful and prolonged experimental and clinical investigation by the members of the committee themselves.

The members of that first committee acted on a sense of responsibility for the preservation of human life: a moral sense not so evident in a more recent committee—the Council on Physical Therapy of the American Medical Association—which "accepts"—that is, approves—"resuscitators" on the basis of no personal investigation by any of its members—as admitted in their letters to me—other than the secretary, who is a mechanical engineer of no physiological training or medical experience.

The main point developed by the committee of 1912 in regard to manual methods of artificial respiration was, not that any one of them—whether Schafer, Silvester or others—induces a much larger ventilation of the lungs than any other—in fact, without inhalation of carbon dioxide too large a ventilation would be harmful; but that the prone pressure method has the great advantage that it can be applied immediately: a delay of even a few seconds, while apparatus is being brought and applied, may lose a life. Prone pressure is easier to teach and learn than any of the other methods; it can be continued longer without exhausting the operator; and it aids the circulation by pushing blood toward the heart. Accordingly the Schafer prone pressure method was adopted, particularly by the American Red Cross, and the pulmotor and similar breathing machines (not then claiming the title of "resuscitators") which rely on alternately sucking and blowing were condemned. The resuscitation committee held that "inflation and deflation of a bag are deceptive because the bag, unlike the air passages of the body, offers no resistance till full. As soon as the inspiratory blast meets an obstacle in the air passages, it is automatically cut off and turned into expiration; and thus frequently no effective inspirations are performed." Thus the time within which the victim may be saved is lost while the apparatus merely clicks back and forth ineffectively. This has continued to be, and is now, the position of the American Red Cross (see its booklet on "Life Saving and Water Safety," page 189). It advocates (1) immediate manual prone pressure artificial respiration, and (2) simple inhalators as auxiliary aids; but it disapproves of suck and blow mechanical devices.

Between 1912 and the present time, four other committees have published the results of their investigations on methods of resuscitation: two in this country, one in 1918 and one in 1921, and one under the British Medical Research Council. Three of these committees have unanimously condemned suck and blow apparatus under whatever name; while only one—the above-mentioned Council on Physical Therapy—has accepted such devices. And thereby hangs the grotesque story which it is one of the objects of this article now to tell.

WHY DOCTORS PROMOTE "RESUSCITATORS"

The story is that of how and why it has come about that at the present time a large proportion of American physicians believe that the American Medical Association, through its Council on Physical Therapy, recommends "resuscitators"—a belief which is the principal basis for the extensive introduction of this apparatus. As a result, the sales agents of the E & J—as the most promoted of these devices is commonly called—find in every city and town of the United States one or several physicians of good standing in the community who are "members of the A.M.A." and read its journal and who on this basis confidently and conscientiously assure their fellow citizens that the purchase of a "resuscitator" for the hospital or the fire department is a public-spirited act.

Commercially, the sales campaign of the E & J is thus far ethical. But it does not stop at measures that are scientifically and commercially ethical. Three times at least that campaign has involved attempts to prevent the publication of scientific opinion or evidence adverse to the E & J "resuscitator." It happens that the first report adopted by the Council on Physical Therapy was never published. It was adverse to the E & J "resuscitator." I know, because I wrote it. I was at that time a member of the council and, as I had already tested the "resuscitator" on animals in my laboratory and had found it to be essentially a pulmotor, I was asked by my colleagues to draft the council's report. It was approved and adopted by the council. It was, in fact, on the point of publication in the *Journal* of the American Medical Association. But at that point unfortunately the E & J Company learned—or were informed—that the report was adverse. Thereupon they sent their lawyers to the then president (1934-35) of the American Medical Association and the report was suppressed by action of the trustees; and I resigned from the council. On my part this was a conscientious, but unwise act; for the agents of the E & J thereupon set themselves to winning the secretary of the Council on Physical Therapy to the support of their device. In contravention of that influence, I then invited the council to delegate a subcommittee of its members to join with me in testing the "resuscitator" on animals. Whether that invitation ever reached the full council, I do not know. But I do know that it reached the secretary, and that he made no reply. I know also that soon thereafter the agents of the E & J achieved their object: instead of their "resuscitator" being disapproved, it was added to the "list of devices accepted by the Council" (see *Jour. Am. Med. Asn.*, 112: 1945, May 13, 1939). Ever since that it has been supported in frequent published statements by the council as being at least as efficient a means of artificial respiration as the Schafer prone pressure method.

In this respect, the American Medical Association is in direct antagonism to the American Red Cross.

Twice in recent years the lawyers of the E & J Company have threatened suit against the publishers of the books in which I have reported my investigations in the field of resuscitation. One of these publishers ignored that threat with the scorn that it deserved. And nothing happened. The other publisher took the matter so seriously that he delayed the publication of the book ("Noxious Gases," by Henderson and Haggard), for six months and went to considerable expense for legal advice—as did I also—in defense of the right of an author to tell the truth.

In addition, it is of interest—to me at least—that in the latest advertisement of the E & J "resuscitator" one of those books is cited as supporting that device.

So matters have gone on until in their hunger for sales the agents of suck and blow apparatus have nagged bureaus in the U. S. Army, Navy and Shipping Board to the point of asking the National Research Council for the appointment of a committee on the subject of "resuscitators." That committee met recently and made its report; and this report is about as adverse to "resuscitators" as is this article of mine.

So far so good. The various bureaus of the Federal Government will now be saved very considerable amounts of money, as well as the lives of many soldiers, sailors and marines. But that report is unfortunately "restricted" and will not decrease the mortality from asphyxia among the 130 million citizens of the United States, who will never hear of it.

THE CENTENARY OF THE CINCINNATI OBSERVATORY

By Dr. RAYMOND WALTERS

PRESIDENT OF THE UNIVERSITY OF CINCINNATI

THE commemoration in November, 1943, of the establishment in November, 1843, of the first astronomical observatory in America proved to be an occasion of national importance. Testimony to this importance was supplied in the felicitous letter of greeting received by the University of Cincinnati from the President of the United States:

> The founding of the Cincinnati Observatory a hundred years ago was an event of great significance in the march of science and culture in this country.
>
> The enormous advance in the science of astronomy since the venerable John Quincy Adams, former President, journeyed to Cincinnati to lay the cornerstone of the original building emphasizes the debt we owe to the Cincinnatians of a century ago whose vision and generosity made possible the establishment of the observatory.
>
> May I, in extending hearty greetings, express the hope that the work of the observatory will go steadily forward and that the sphere of its influence will ever widen in the decades ahead.

As reported in SCIENCE, the American Astronomical Society held its seventy-first annual meeting at Cincinnati from November 5 to 7, in conjunction with the university celebration; and digests of the papers then read have been published in this journal.

Scientific and human aspects of what Dr. Harlow Shapley, president of the society, termed "this romantically founded civic enterprise" were presented before a large audience of scientists and citizens in three centenary addresses delivered by Dr. Shapley; Mr. Robert L. Black, a member of the board of directors of the University of Cincinnati; and Dr. Raymond Walters, president of the university.

The historic background of Cincinnati a hundred years ago and the personality of Professor Ormsby MacKnight Mitchel, of Cincinnati College, founder of Cincinnati Observatory, were sketched by Mr. Black. In vivid, picturing words, he described the laying of the cornerstone of the Cincinnati Observatory on "that chilly November day when a national salute of 21 guns fired from Mount Ida, re-echoing from the low, heavy clouds, roused the 50,000 odd inhabitants of Cincinnati." The orator of the day was the illustrious John Quincy Adams, "small, neat, a quiet personage, still apple-cheeked in spite of his 76 years," who had endured rain, snow, cold and the rigors of a thousand-mile journey from Massachusetts to accept the invitation of Judge Jacob Burnet, one of the founders of Cincinnati College and president of the Cincinnati Astronomical Society.

Mr. Black depicted the scene: "Judge Burnet, tall, swarthy, austere," and Professor Mitchel, "a little terrier of a man, sharp-eyed, talkative, full of bounce," sat in the barouche with Mr. Adams as "the heavens opened, filling the streets with water." The long line of citizens paraded through the rain up to the top of Mount Ida, the location of the observatory-to-be. On a small stage there,

> Judge Burnet introduced the ''old man eloquent'' to the auditory of umbrellas. Mr. Adams read his address rapidly; before he was done the manuscript was so defaced by the rain as to be scarcely legible.
>
> Thereupon he laid the cornerstone, ''invoking the blessing of Him, in whose presence we all stand, upon the building which is here to rise and upon all the uses to which it will be devoted.

Mr. Black then recounted the dramatic story of how it happened that a President of the United States, a judge and a professor thus met on a hilltop overlooking the Ohio River. The hero of the story was Ormsby MacKnight Mitchel, Kentucky-born son of Scotch-Irish folk, graduate of West Point, engineer, professor of mathematics and natural philosophy in Cincinnati College, and astronomer.

There was at that time no working telescope in America. Mitchel, lecturing on astronomy at Cincinnati, saw a vision. He "resolved to devote five years to the erection of a great astronomical observatory right here in the City of Cincinnati."

> He had not a penny in his pocket, no future prospect whatever except his $1,500 a year for teaching; he had little influence, political or social. ''I will go to the people,'' he said . . . ''I will plead the cause of science. . . . I am determined to show the autocrat of all the Rus-

sias that an obscure individual in this wilderness city in a republican country can raise here more money by voluntary gift in behalf of science than his majesty can raise in the same way throughout his whole dominions.''

And *that* he did.

How Mitchel organized the Cincinnati Astronomical Society, sold $6,500 worth of stock, went to London, then to Munich and there got an option on a $9,000 telescope, a 12-inch glass exceeded only by the Pulkova telescope; how he returned home and finally raised the balance due; how he obtained land for an observatory site and personally superintended the erection of the building; how he began publication of an astronomical journal, *The Sidereal Messenger*—all this was stirringly related in Mr. Black's admirable paper.

The address of President Walters outlined the academic background of Professor Mitchel's Cincinnati College which, founded in 1819, continues within the University of Cincinnati to-day. In the decade 1835–45, Cincinnati College had a remarkable flowering. Its faculty included President William H. McGuffey, author of the school books which influenced American life for several decades; Dr. Daniel Drake, who headed a medical department as brilliant as any in America of that day; Timothy Walker and John C. Wright, who made the law school famous for their *Western Law Journal* and for their classic texts in American law; and E. D. Mansfield, professor of history and journalist. Professor Mitchel served in this era as a teacher of mathematics, science and engineering. He began at Cincinnati College in 1836 one of the first collegiate courses of civil engineering in the United States.

Touching upon Professor Mitchel's astronomical dream and achievement, the speaker said:

> This little giant of Scotch Irish ancestry applied his powers of intellect, personality and character to fulfillment of St. Paul's dictum: ''This one thing I do.'' Despite discouragement, obstacles and disaster, he accomplished the thing he set out to do, which was the establishment in America of an astronomical observatory to rank with those of Europe.
>
> Then Professor Mitchel wrote, with quiet pride: ''The building of the Cincinnati Observatory has forever settled the great question as to what a free people will do for pure science.'' That utterance had the same noble tone of faith in the people embodied exactly twenty years later in the address of Lincoln at Gettysburg, November, 1863, in the midst of a war in which the college professor and astronomer of Cincinnati was to serve as a general in the Union Army.

The speaker went on to say that "such faith in the people was validated by the way in which the citizens of Cincinnati in Mitchel's own and later generations have carried on the enterprise he established."

As an outcome of a proposed merger of the old Cincinnati College, the newly created McMicken University and the Cincinnati Observatory, the University of Cincinnati was established in 1870. The Cincinnati Astronomical Society voted to merge with the university, and in 1878 the City of Cincinnati acted to maintain the observatory by taxation. In 1918 the city tax for the observatory was combined with that for the entire University of Cincinnati.

"The vital point is that the city tax continues to-day as the source of the observatory's income," Dr. Walters said. "Cincinnati is still fulfilling the faith of Ormsby MacKnight Mitchel as to what a free people will do for pure science."

"The Cincinnati Observatory has worked chiefly in sidereal astronomy and its long-continued studies of the proper motion of the stars have, in the words of Professor S. A. Mitchell, of the University of Virginia, 'made Cincinnati Observatory famous throughout the astronomical world.' "

We have confidence that, in the years to come, the high tradition established by Mitchel, carried on by Stone, Abbe, Porter, Yowell, and Elliott Smith will be advanced under Paul Herget, who is to return and become director of the observatory following termination of his present duties at the U. S. Naval Observatory.

To the advancement of the Cincinnati Observatory upon its fundamental ideals of scientific aspiration and popular support, I am privileged to pledge the cooperation of the University of Cincinnati and the people of Cincinnati.

Dr. Shapley began his address with felicitations to the University of Cincinnati upon the observatory centenary, and congratulations upon the appointment of Dr. Paul Herget as director to succeed the late Dr. Elliott Smith. Said Dr. Shapley:

> About a hundred years ago a famous English scientist pointed out to the citizens of Cincinnati what they should do to become the zero-point of the Western Hemisphere. Cincinnati would be to America what Greenwich is to England. Actually the plan didn't come off, perhaps because Cincinnati didn't want to be zero in anything. But at about the same time there was much interest in Cincinnati concerning a new European theory that the center of the universe is in the bright star cluster called the Pleiades.

Dr. Shapley then outlined the contributions made during the century since the founding of the Cincinnati Observatory to "the questions of centers,—the center of the earth, the center of the solar system, the center of the Milky Way." He raised the question: "Does the universe itself have a center?"

As to the theory of Maedler, well-known astronomer at Dorpat a century ago, that the bright star Alcyone in the Pleiades is the central body of the sidereal universe, Dr. Shapley explained that, while Maedler's arguments were good, "subsequent research has shown that the center of the galaxy is in the Sagittarius, almost diametrically opposite to the place where it was put by Maedler. The distance is not a few hundred light years but more than 30,000 light years."

Dr. Shapley went on to say that the motion of the sun that was recognized a hundred years ago is not a motion of rotation around a galactic center, but is the sun's own private random motion with respect to neighboring stars. The rotation around the Milky Way center is some 200 miles a second and takes with it all the neighboring stars. The central nucleus of the Milky Way galaxy is for the most part invisible and immeasurable.

Dr. Shapley referred to various dynamic, photometric and spectroscopic ways in which astronomers now "explore the half-seen central nucleus of our galaxy. The researches on stars in the direction of the Pleiades are used to find the distance to the anticenter, that is, the distance to the rim of our wheel-shaped galaxy."

The speaker reported on the progress of Harvard researches on the galactic nucleus and the galactic anti-center, as well as on the diameter and thickness of the Milky Way. Illustrative slides were shown.

But the center of our galaxy is not the center of the universe. The identification of the spiral nebulae as external galaxies has completely changed the concept of a universal center. Our own galaxy is found to be a few hundred thousand light years from the center of the local supergalaxy, or group of galaxies.

But far beyond the bounds of our own local group of galaxies, we have mapped the positions of 500,000 other great stellar systems, and the questions before us now are: Is there a boundary to this overall system, the metagalaxy? Is there at the present time a great central dominating galaxy or group of galaxies? Is our galaxy or some other recognizable system at or near a center from which the other galaxies are receding in the expanding universe?

Dr. Shapley said that "nowhere do we find one king of all galaxies, enormous in mass and superlative in brightness. In fact, we seek in vain for a metagalactic center." He concluded that "there is no very good evidence that the universe is infinite or that it is finite."

There follow biographical sketches of the founder and first director of the Cincinnati Observatory and of its third director, Cleveland Abbe, under whom the observatory initiated a system of daily weather reports and storm predictions which led to the establishment of the United States Government Weather Bureau.

ORMSBY MacKNIGHT MITCHEL

1809–1862

THE energy and perseverance of Ormsby MacKnight Mitchel accomplished the task of building and equipping an observatory by popular contributions, a century ago in Cincinnati. Mitchel was born in 1809 in Kentucky of pioneer stock. When he was seven years of age, his father died and his mother moved to Lebanon, Ohio. He was taught at home, and then entered a school conducted by his brother. On account of limited finances, he started to support himself at the age of thirteen. An appointment to West Point gave him the desired opportunity to study, and after graduation, he taught mathematics for two years. Assigned to duty at St. Augustine, Florida, he soon grew tired of the tedium of garrison duty, resigned his commission and went to Cincinnati. First he tried the law, but without success; then he became professor of mathematics and natural philosophy at the old Cincinnati College.

In 1842, Mitchel delivered a course of lectures on astronomy that aroused great interest; at the last lecture he proposed a plan to build an observatory. He would solicit subscriptions of stock at $25.00 a share, and when 300 shares were subscribed, he would call a meeting of stockholders and organize a society. This he did; a constitution was adopted, and officers elected, including Judge Jacob Burnet as president and O. M. Mitchel as astronomer. Mitchel was sent to Europe to buy a telescope; finding nothing suitable in London or Paris, he went on to Munich, where he found a 12-inch glass, equal to Lamont's and inferior to the Pulkova telescope alone. Its price exceeded the funds in the treasury, but he ordered it and went home to raise the balance.

The building of an observatory was the next difficulty: Judge Nicholas Longworth donated four acres of ground on a hill east of the city, on condition that the building should be finished in two years; various citizens became stockholders, paying in cash or material or labor. The venerable John Quincy Adams was invited to lay the corner-stone—his interest in science was well known and, when President, he had recommended to Congress the founding of a national observatory. Though 77 years old, he accepted the invitation and traveled to Cincinnati by rail, by lake boat, by canal and finally by stage-coach. The city council met him at the city limits and escorted him to his hotel; the next day a parade, composed of military and civilian groups, conducted him to the hill, where he laid the corner-stone and delivered his address in spite of pouring rain. The city council named the hill Mt. Adams in his honor.

Mitchel promised to conduct the observatory for ten years without remuneration; when the college burned down he was forced to earn his living by other means; yet his courage never failed, even though very little observing could be done. He made surveys for the Little Miami Railroad, now a part of the Pennsylvania system; later he made surveys for the Ohio and Mississippi Railroad, now called the Baltimore and Ohio Southwestern.

He tried lecturing on astronomy and was remarkably successful; his audiences were large and enthusiastic. In the spread of astronomical knowledge, in drawing the attention of thinking people to the beauties of astronomy and inspiring them with enthusiasm he paved the way for the founding of other observatories, the endowment of other institutions, and attracted to the subject young men of ability whose later work was creditable to American astronomy.

Another venture of Mitchel's was the publication of a popular journal on astronomy called the *Siderial Messenger;* two complete volumes were published, but it expired after a few numbers of the third volume appeared.

Mitchel worked on the problem of applying the electric current to record observations; his disk chronograph worked but was not as good as the cylindrical one developed by the Bonds.

In 1859 Mitchel was appointed director of Dudley Observatory and went to Albany in the following spring. But already the war drums were beating and on the outbreak of war, he resigned and was appointed a brigadier general in the U. S. Army. He conducted a successful campaign in the west, going as far south as Huntsville, Ala. He was transferred to the Carolinas and succumbed to yellow fever at Beaufort, S. C., on October 30, 1862. Professor Holden, first director of the Lick Observatory, speaks thus of his work:

> His direct service to practical observing astronomy is small, but his lectures, the conduct of the Cincinnati Observatory and the publication of the *Siderial Messenger*, together with his popular books, excited an intense and wide-spread public interest in the science and indirectly led to the founding of many observatories. He was early concerned in the matter of utilizing the electric current for longitude determinations, and his apparatus was only displaced because of the superior excellence of the chronograph devised by the Bonds. His work was done under immense disadvantages, in a new community, but the endowment of astronomical research in America owes a large debt to his energy and efforts.

CLEVELAND ABBE

1838–1916

CLEVELAND ABBE, the third director of the Cincinnati Observatory, was born in New York in 1838. He graduated from the College of the City of New York in 1857, studied under Brünnow at Ann Arbor for two years and worked with Gould at Cambridge during the period 1860–64. Then he spent two years as student and assistant under Otto Struve at Poulkova. Returning home, he served in the United States Naval Observatory for a short time and was called to Cincinnati in 1868 to rehabilitate the Cincinnati Observatory.

Abbe's interest in meteorology was early developed and continued all his life. He said:

> The popular articles in the New York papers by Merriam, Espy, Joseph Henry and others—notably Redfield and Loomis—had by 1857 convinced me that man should and must overcome our ignorance of destructive winds and rains.

The opportunity to investigate weather conditions came to him in Cincinnati. Thus he described it:

> In my inaugural Cincinnati address of May 1, 1868, I stated that with a proper system of weather reports the public need of forecasts could be met and that astronomy could also be benefited.
>
> The suggestion was taken up by Mr. John A Gano, president of the local chamber of commerce: a committee met me, approved my plans, and promised the expenses of a first trial.

The Western Union Telegraph Company cooperated with Abbe and the Chamber of Commerce: observers in other places made the meteorological observations at a specified time and telegraphed them to Cincinnati. The Chamber of Commerce paid the expenses for the first three months; Abbe analyzed the data and made the predictions. He made a map on which were located the places sending the data, the temperature, direction of wind and weather. These were manifolded and sent to the various subscribers; and the predictions were also published in the daily papers. On September 1, 1869, the first *Cincinnati Weather Bulletin* appeared; at the end of three months, the Western Union assumed charge of the *Bulletins* and Abbe continued to make the predictions. He was nicknamed "Old Probs" by the employees of the Western Union, a name that clung to him, but has sometimes been applied to other weather men.

Abbe resigned in 1870 to accept a position as assistant in the office of the Chief Signal Officer. By a law, passed by Congress in 1870, the creation of a weather service was authorized and placed under the direction of the Signal Service of the Army.

Abbe organized the forecast work and began preparing the tri-daily synopses and probabilities of the weather. He also inaugurated the *Monthly Weather Review* and contributed a great many articles to this publication; he took a leading part in all the activities of the national weather service. In virtue of his having started a weather service here in Cincinnati and having published his "probabilities," we consider his work here as a forerunner of the present national Weather Bureau.

In 1912, the Symons Memorial Gold Medal of the Royal Meteorological Society was bestowed upon him, and the president, Dr. H. N. Dickson, paid him this tribute: He "has contributed to instrumental, statistical and thermodynamical meteorology and forecasting" and "has, moreover, played throughout the part, not only of an active contributor, but also of a leader who drew others into the battle and pointed out the paths along which attacks might be successful."

It is highly appropriate that a tablet, with this inscription, is placed in the Abbe Meteorological Observatory in Cincinnati:

U. S. Department of Commerce
Weather Bureau
ABBE METEOROLOGICAL
OBSERVATORY
Established April 1, 1915
Named in Honor of
1838 CLEVELAND ABBE 1916
First official U. S. Weather Forecaster

EVERETT I. YOWELL

OBSERVATORY OF THE
UNIVERSITY OF CINCINNATI

OBITUARY

DEATHS AND MEMORIALS

DR. EPHRAIM PORTER FELT, entomologist, director of the Bartlett Tree Research Laboratories, from 1898 to 1928 New York State entomologist, died on December 14. He was seventy-five years old.

DR. JOHN HARVEY KELLOGG, surgeon, director of the Battle Creek Sanitarium and founder of the W. K. Kellogg Company, died on December 14 at the age of ninety-one years.

PROFESSOR CHARLES HENRY HAWES, anthropologist, a former associate director of the Museum of Fine Arts at Boston, died on December 13. He was seventy-six years old.

THE hundredth anniversary of the birth of Robert Koch occurred on December 11. *The New York Times* writes: "Forty years ago the death rate from that once dreaded disease was 200 per 100,000; today it is 40 per 100,000—a decline of 80 per cent. No longer is tuberculosis the leading cause of death; it now ranks eighth on the list of deadly diseases. This improvement can be explained only in terms of the remarkable discovery made by Robert Koch that tuberculosis is caused by a bacillus—a discovery that made it possible for physicians to consider tuberculosis as a scientific problem."

SCIENTIFIC EVENTS

THE POST-WAR FORESTRY POLICY OF GREAT BRITAIN

A POST-WAR forestry program, which aims at increasing the forest area of Great Britain to 5,000,000 acres in the course of five decades, is recommended in a report to the Government by the Forestry Commissioners which was recently presented to Parliament by the Chancellor of the Exchequer. It is described by the Parliamentary correspondent of *The Times*, London, who says that this White Paper on "Post-War Forest Policy" is an important contribution to wider schemes of planning, and aims at reconciling claims of amenity with economic utilization in the use of more land for the growing of trees. He continues:

> For the second time in a generation British woodlands are being subjected to intensive exploitation to meet war needs. The total area of woodland felled or devastated during and immediately after the last war was about 450,000 acres. Depletion will certainly go much farther in this war than in the last, and the scale of reconstruction will have to be correspondingly larger. The forestry position is already much worse than it was in 1918, and a reorientation of thought is necessary.
>
> We have had a national forest policy only since 1919, when the Forestry Commission was established. In spite of checks owing to "lack of stability of finance" a national forest estate aggregating 714,000 acres of plantable land has been acquired; and of this 434,000 acres were under woodlands by the end of 1939. The new State plantations are making a contribution, but the great bulk of home-produced timber now being felled is coming from private woodlands. To reduce imports and save shipping millions of tons annually of timber are being provided from home sources.
>
> The report suggests that the nation should now make up its mind to devote 5,000,000 acres to afforestation. That area is required for national safety and will also provide a reasonable insurance against future stringency in world supplies. (It is estimated that the area proposed would ultimately produce about 35 per cent. of the normal consumption of timber.)
>
> These 5,000,000 acres should be not merely planted with trees, but also systematically managed and developed. It is estimated that 5,000,000 acres of effective forest can be secured by the afforestation of 3,000,000 acres of bare ground and by selecting from existing woodlands 2,000,000 acres of those which are better suited for forestry than

for any other national purpose. It is proposed that the 2,000,000 acres of existing woodlands, so far as they are privately owned, should be either "dedicated" by their owners to forestry or acquired by the State.

The planning of the further 3,000,000 acres would mean the transfer to timber growing of this area from the 16,000,000 acres of uncultivated land at present classified as "rough grazings." The land for afforestation would be drawn only gradually from its present use and the loss to food production would be relatively small. The maximum area of bare land to be planted in the first post-war decade would be 500,000 acres.

It is proposed that the attainment of the 5,000,000 acres of effective forest should be spread over fifty years, though the rate of progress be subject to review and amendment.

The policy is also considered from the point of view of employment. It is estimated that the employment that would be provided by 5,000,000 acres of forest in full working order would be 50,000 men in the forests working full time and 200,000 in forest industries, a total of 250,000. These figures would be attained very gradually.

There are at present three national forest parks. The report suggests that without special effort one new park of this kind might be established every year for the next ten years at a capital outlay not exceeding £50,000; and that for the expenditure of £150,000 the total number of national forest parks could be increased to twenty by the end of the first post-war decade. There are twelve youth hostels in the existing national forest parks, and the report foreshadows an extension of the provision for recreational facilities in the new parks, with semi-permanent camps. It suggests that, if in view of the large schemes here outlined, Parliament should desire to place forestry under the direct control of a Minister, the Minister chosen should be the Lord President of the Council, and that he should be assisted by a committee, including the Secretary of State for Scotland, the Minister of Agriculture and the chairman of the Forestry Commission.

The chairman of the Forestry Commission is Sir Roy Robinson, and its members include representatives of all political parties.

THE RESEARCH COUNCIL ON PROBLEMS OF ALCOHOL

A GENERAL plan of reorganization of the Research Council on Problems of Alcohol was approved by the council on November 23. The provisions of the plan are as follows:

(1) The officers will consist of a president, six vice-presidents, a secretary and a treasurer. The president, secretary and treasurer shall be *ex-officio* members of the Board of Directors.

(2) The Board of Directors will consist of 40 members, 28 to be chosen on a regional basis, and 12 to be members at large. It will be made up of an increasing number of businessmen. The board will meet annually—if practicable, at the time of the council's annual business meeting and the annual meeting of the scientific committee.

(3) An executive committee of seven members of the board will meet quarterly, with additional meetings as required.

(4) The new board and its executive committee will give special attention to the business and financial affairs of the council.

(5) An executive committee of seven members of the scientific committee will be appointed to give closer attention to research on the treatment of alcoholism.

(6) A new committee on alcoholism will be created. It will be composed of doctors treating alcoholics, liquor control administrators and representatives of the church, the distilling industry and the alcoholics anonymous group, together with others having some special interest in the problem of alcoholism. Sub-committees will be appointed to deal with the following subjects: The dissemination of the results of research, the treatment of alcoholism, the development of hospital facilities, state and local organizations, and the legal aspects of alcoholism.

REORGANIZATION OF THE PUBLIC HEALTH SERVICE

As reported in the *Journal* of the American Medical Association, Dr. Thomas Parran, surgeon general of the U. S. Public Health Service, has announced the appointment of heads of the five new bureaus and divisions set up through the reorganization of the U. S. Public Health Service by Congress on November 11.

The reorganization was authorized in the enactment of a bill (S. 400). Dr. Lewis R. Thompson, medical director serving in the surgeon general's office, has been named assistant surgeon general in charge of the new Bureau of States Services. Dr. Ralph C. Williams, formerly district director with headquarters in New York, has been named assistant surgeon general in charge of the new Bureau of Medical Services. Dr. Rolla E. Dyer, director of the National Institute of Health, Bethesda, Md., will in addition serve as assistant surgeon general in charge of the new Bureau of Scientific Research. John K. Hoskins, senior sanitary engineer, under the new set-up will become chief of the division of sanitary engineering and William T. Wright, Jr., D.D.S., chief of dental work in the Marine Hospital Division of the Public Health Service, will become chief of the division of dentistry. All five will hold rank comparable to an army brigadier general. They have been in a grade comparable to a full colonel in the army. Mr. Hoskins is said to be the only non-doctor or dentist to hold a rank in the Public Health Service comparable to brigadier general. S. 400 provides that the surgeon general of the Public Health Service, under the supervision and direction of the Federal Security Administrator, is authorized and directed to assign to the Office of the

Surgeon General, to the National Institute of Health and to the Bureau of Medical Services and the Bureau of States Services, the functions of the Public Health Service and to establish within the office of the surgeon general and the other groups named such divisions, sections and other units as may be required to perform their functions.

NATIONAL RESEARCH COUNCIL GRANTS FOR RESEARCH IN ENDOCRINOLOGY

It is announced that requests to the National Research Council Committee for Research in Endocrinology for aid during the fiscal period from July 1, 1944, to June 30, 1945, will be received until February 28. Application blanks may be obtained by addressing the Division of Medical Sciences, National Research Council, 2101 Constitution Avenue, Washington, D. C. In addition to a statement of the problem and research plan or program, the committee desires information regarding the proposed method of attack, the institutional support of the investigation and the uses to be made of the sum requested. No part of any grant may be used by the recipient institution for administrative expenses. Applications for aid of endocrine research on problems of sex in the narrower sense can not be given favorable consideration, but the committee will consider support of studies on the effects of sex hormones on non-sexual functions—*e.g.*, on metabolism.

ANDREAS VESALIUS

The Historical Library of the Yale University School of Medicine has arranged for the publication of a life of Andreas Vesalius, the great military surgeon and one of the most important figures in medicine of all time. During the winter of 1544, Vesalius served with the armies of Charles V in the Marne Valley, at Soissons, Château Thierry and the Argonne. His biographer, the late Dr. Harvey Cushing (Yale 1891), had struggled in the same terrain in the last war, and he dedicated the energies of the last years of his life to the portrayal of the life and work of Vesalius.

Plans had been laid to celebrate the four hundredth anniversary of the birth of Vesalius in 1914, but the last war prevented the observance, and the Louvain Library, which contained many of the most important relics, was destroyed. The Historical Library, where Dr. Cushing's great Vesalian collection is housed, not only celebrated, as it did on October 30, the 400th anniversary of Vesalius' book "On the Structure of the Human Body," but also published Dr. Cushing's "Bio-bibliography of Andreas Vesalius" (issued by Schuman's in New York). In acknowledging assistance which has come from Dr. W. W. Francis, of the Osler Library in Montreal, of Dr. Edward Clark Streeter, curator of Museum Collections of the Yale Medical Library, and of Dr. Arturo Castiglioni, research associate in the history of medicine and formerly professor of medical history at the University of Padua, Dr. Fulton in his preface comments:

> Because of his knowledge of anatomy Vesalius undoubtedly found himself better equipped to deal with war injuries than many of his contemporaries, excepting of course Ambroise Paré who, like many surgeons of 1943, had learned anatomy the hard way—in the field of battle. For these, and many other reasons, we have persevered in bringing out the Vesalius bio-bibliography in 1943, at a time when physicians on every battle front will undoubtedly welcome a reminder of the man who at the early age of twenty-eight years first adequately portrayed the fabric of the human body. When the lights burn low and tradition falters, we must carry the torch of remembrance until it can flame again and brighten the paths of learning and free thought for those who now ''sit in darkness and in the shadow of death.''

SCIENTIFIC NOTES AND NEWS

The Association of Military Surgeons of the United States on October 22 presented its Gorgas Award to Hugh S. Cumming, surgeon general, U. S. Public Health Service, retired, and at present director of the Pan American Sanitary Bureau. The award was founded in 1942 by John Wyeth and Company of Philadelphia and consists of a medal and scroll and $500. It is given each year to a member of the association who has made "notable contribution to medical science of value to the military service."

The Massachusetts Horticultural Society has awarded the George Robert White Medal to Richardson Wright, of New York City, editor of *House and Garden*.

A dinner in honor of Dr. Carl J. Wiggers on the completion of twenty-five years as professor and head of the department of physiology at the School of Medicine of Western Reserve University, was given on November 18 by his associates and students. Dr. Torald Sollmann, dean of the medical school, presided.

Honorary memberships in the American Society of Mechanical Engineers given to "persons of acknowledged professional eminence elected by unanimous vote of the council" were conferred at the sixty-fourth annual meeting in New York City on Francis Blossom, of New York, fellow of the society and a partner of Sanderson and Porter, Engineers; on

Ralph Budd, of Chicago, president of the Chicago, Burlington and Quincy Railroad; on Edward N. Trump, of Syracuse, N. Y., fellow and past-president of the society, a senior member of E. N. and C. C. Trump, mechanical and chemical engineers; and on Roydon V. Wright, of New York, a fellow and past-president of the society, vice-president and secretary of the Simmons-Boardman Publishing Corporation, managing editor of *Railway Age* and editor of the *Railway Mechanical Engineer*.

THE *Journal* of the American Medical Association reports that at the meeting on November 6 of the American Academy of Pediatrics in Chicago the 1943 recipients of the Mead Johnson awards were announced. The first prize of $500 was given to Dr. Hattie E. Alexander, New York, for her work on "The Treatment of the *H. influenzae* Infections," and the second prize of $300 to Dr. Philip Levine, Newark, N. J., for his work on "Erythroblastosis Faetalis and the Rh Factor." At the meeting Dr. Joseph S. Wall, Washington, D. C., was named as president-elect of the academy and Dr. Franklin P. Gengenbach, Denver, was installed as president. Dr. Clifford G. Grulee, Evanston, Ill., was reelected secretary-treasurer.

DR. DUNCAN A. MACINNES, physical chemist, a member of the Rockefeller Institute for Medical Research, was elected president of the New York Academy of Sciences at the one hundred and twenty-sixth annual meeting on December 15.

DR. MAX NEUBURGER, formerly professor of the history of medicine at the University of Vienna and since 1939 associated with the Wellcome Historical Medical Museum in London, observed his seventy-fifth birthday on December 8.

LIEUTENANT-COLONEL EDGAR PAM, consulting engineer to and deputy delegate director of the Mond Nickel Company, Ltd., has been elected president of the Institution of Mining and Metallurgy for the coming session.

DR. FOREST F. HILL has been appointed head of the department of agricultural economics of Cornell University, and Cedric H. Guise has been made head of the department of forestry to succeed Professor A. B. Recknagel, who recently retired. Dr. Hill, who has been professor of land economics and who is a former governor of the Farm Credit Administration, succeeds Dr. W. I. Myers, now dean of the College of Agriculture. Dr. Kenneth Post, associate professor of floriculture, has been made acting head of the department of floriculture.

DR. THOMAS J. HEADLEE, since 1912 head of the department of entomology of Rutgers University and of the State Agricultural Experiment Station, will retire on January 1.

DR. CHARLES ANDERSON ALDRICH, professor of pediatrics at the Medical School of Northwestern University and physician-in-chief to the Children's Memorial Hospital, will organize and direct a long-term research program in preventive medicine in childhood at the Graduate School of the University of Minnesota. The project will be financed by the Mayo Clinic and will be carried out in cooperation with Dr. Henry F. Helmholz, Rochester, Minn., who is in charge of the department of pediatrics at the clinic.

DR. M. W. DEHN, of the Illinois Institute of Technology, has become professor of mathematics at St. John's College, Annapolis.

DR. NATHAN JACOBSON, of the University of North Carolina, has been appointed to an associate professorship of mathematics at the Johns Hopkins University.

DR. GEORGE A. EMERSON, associate professor of pharmacology at the Medical School of the West Virginia University, Morgantown, has become professor of pharmacology at the Medical Branch of the University of Texas. He will continue his work on the effects of anesthetic agents and the effects of drugs in anoxia. Dr. Charles M. Pomerat, professor of biology at the University of Alabama, has been appointed professor of anatomy; R. W. Strandtmann, of the Ohio State University, has become assistant professor of entomology in the department of preventive medicine and public health; Dr. Ardell N. Taylor, of the University of Texas, has been made instructor in physiology and Dr. Jewell G. Hamrick, of the Medical College of Virginia, instructor in pathology.

DR. G. C. WALLIS, associate professor of dairy husbandry, South Dakota State College, known for his work on the vitamin D requirements of dairy cows, has been appointed assistant technical director of the special products department of Standard Brands.

DR. H. E. MYERS, professor of soils at Kansas State College, has been granted leave of absence for two years to serve as agricultural adviser to the Department of State. Since about November 1 Dr. Myers has been working at the American Legation at Cairo, Egypt, and plans to visit parts of North Africa and the Near East. Hugh G. Myers, of the Division of Dry Land Agriculture at Garden City, has accepted a temporary appointment as associate professor of soils during Dr. Myers' absence.

DR. M. G. SEELIG, director of pathology in the Barnard Free Skin and Cancer Hospital, St. Louis, has been appointed a member of the State Cancer Commission by Governor Forrest C. Donnell.

Professor George B. Cressey, who has leave of absence from Syracuse University and who has been appointed visiting professor in China under the program of Cultural Relations of the Department of State, arrived in Chungking on November 22. While *en route* he spent a month in India visiting various universities. Professor Cressey has been appointed by the Secretary of State, Mr. Cordell Hull, and by the National Academy of Sciences to assist in developing closer relations between Chinese and American scholarly organizations.

Professor Pierre Dansereau, of the department of biogeography of the University of Montreal, was a guest of the department of zoology and physiology of the University of Illinois at Urbana from October 15 to November 13. His chief purpose was to confer with Professor V. E. Shelford on problems of ecological research and teaching. Incidentally, he gave a number of lectures at the university on the ecology of the Northwest and the Quebec region.

Dr. Fred C. Koch, director of biochemical research with Armour and Company, Frank P. Hixon distinguished professor of biochemistry emeritus of the University of Chicago, recently spent two weeks at the University of California at Berkeley making a study of the work being carried out by Dr. Herbert M. Evans and his staff in the Institute of Experimental Biology.

Fred Corry Bishopp, assistant chief of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, delivered on December 16 before the Washington Academy of Sciences an illustrated address entitled "Insects and the War."

The William E. Lower lecture of the Academy of Medicine of Cleveland and the Cuyahoga County Medical Society was given on November 19 by Dr. Irvine Page, director of the Lilly Clinic of the Indianapolis City Hospital. His subject was "The Nature of Hypertension."

Dr. Edgar Poth, professor of surgery at the Medical Branch, University of Texas, Galveston, delivered from December 10 to 30 a series of lectures at the Medical School in San Francisco of Stanford University.

Professor L. C. Dunn, of Columbia University, gave on November 30 an address at a meeting of the Society of Sigma Xi at the University of Connecticut on "Soviet Research in the Biological Sciences." He also exhibited a Soviet medical film entitled "Experiments in the Revival of Organisms."

Dr. Herbert M. Evans, professor of anatomy and director of the Institute of Experimental Biology of the University of California, was the guest speaker on December 6 before the staff and students of the Medical Branch of the University of Texas at Galveston. He gave an account of the work of the institute in the isolation and purifying of the anterior pituitary hormones. At a luncheon in his honor he led a discussion on source materials concerning early American experiments in socialized medicine.

Dr. Herbert C. Clark, director of the Gorgas Memorial Laboratory, Panama, lectured in Denver on November 29 and 30, under the auspices of the John and Mary R. Markle Foundation and of the National Research Council. He spoke on "Malaria: Precautions in the Unsanitated Areas of the Tropical Lowlands" and on "Distribution and Complication of Amebic Lesions."

An honor award to the master quartz blowers of the United States was presented at the Exposition of Chemical Industries on December 6 by Dr. Hugh S. Taylor, professor of chemistry at Princeton University. The award was accepted by George Kennell, Hanovia Chemical and Manufacturing Company, Newark.

The two hundred and fifty-ninth meeting of the American Physical Society, the 1943 annual meeting, will be held at Columbia University on Friday and Saturday, January 14 and 15. The American Association of Physics Teachers holds meetings at the same time and the Physical Society will take part in its symposium. The Electron Microscope Society of America will hold its first meeting in conjunction with the Physical Society. According to the *Bulletin* of the society "the distinction of their programs is such that the officers of the Physical Society have felt justified in arranging for no papers, beyond the retiring presidential address and the contributed ten-minute papers."

Development of an aboretum devoted primarily to the trees native to Pennsylvania, at the Bowmans Hill State Wildflower Preserve, has been planned for this year, which is the three hundredth anniversary of the birth of William Penn. This preserve is at Washington Crossing Park and was established nine years ago. The arboretum will comprise twelve acres and will be designated "Penn's Woods" in honor of William Penn, founder of Pennsylvania.

In a recent raid the Hull Municipal Museum was completely gutted by fire and all the material destroyed. In addition all records were lost. The material destroyed includes the Norman collection of diatoms; the Dobree collection of European noctuae;

the Russell, Barker and Boult collections of butterflies and moths; the Schlesch and other collections of marine, land and fresh-water mollusca; the Swailes collection of eggs, and the Boynton, Pease and Fortune collection of British birds.

FIRMS in the Swedish rubber industry together with the Swedish Cooperative Union, have formed a company to provide Professor Svedberg, head of the Physical Chemical Institute at Uppsala, with better facilities for working out his process for the manufacture of synthetic rubber using calcium carbide as the main raw material. The initial capital of the company is 175,000 kr., but this is capable of being increased to 525,000 kr. The site for an experimental works and for a new laboratory has already been purchased near Uppsala.

The Lancet states that as a tribute to the courage and endurance of the people of Malta, the Nuffield Foundation has, with the approval of Lord Nuffield, offered to provide grants for the training in Great Britain of six Maltese physicians chosen by the government of Malta for appointments in the public service of the island. The grants will be tenable for a period not exceeding two years. The men or women who are chosen will receive a grant of £400 per annum if unmarried, and £600 if married and a further allowance in traveling expenses. The recipients will be required to give an undertaking to return to the island at the end of their training to take up the appointment for which they have been selected. The institutions in which they will receive their training will be chosen by the trustees of the foundation in consultation with the Colonial Office.

DISCUSSION

CONFUSION OVER GLACIAL LAKE SPOKANE

No small part of exploratory science has been the work of amateurs. In general they have received generous treatment from professional researchers, though no doubt they are annoying at times. The amateur can sometimes function, figuratively speaking, as a navigator of a trial balloon. Having no reputation at stake he may "take a flyer" into a field which looks unpromising to a professional. Twenty-one years ago SCIENCE (September 22, 1922) published a report of such an adventure. The reporter who is now furnishing this memorandum had encountered difficulties in getting information needed for making the physiographic features of the Spokane region have any meaning to his high-school students in general science. After fruitless inquiries of local and some other geologists and eighteen months of puzzling in the local field, two trial papers were written—the first for the students, the second read before the Associated Engineers of Spokane. The latter was sent to Chicago University Geology Department and to the U. S. Geological Survey. That summer, 1922, both sent representatives to investigate. One could find nothing with which to agree. The other seemed to be in substantial agreement. (The Chicago representative's visit was the beginning of a series of eight field seasons spent in this locality, and a very interesting controversy.)

This interest shown by real geologists gave the amateur courage to send his conclusions to SCIENCE for publication. They dealt almost exclusively with evidence of glaciation about Spokane. For the present memorandum the important matter among the thirteen conclusions presented was the evidence of a glacial lake in the valley of the Spokane River, formed by an ice dam made by a lobe of the Cordilleran ice-sheet which approached Spokane from the north and extended almost due south on its eastern margin, at least to a short distance south of Spangle, twenty miles south of the city. This eastern margin was marked by a moraine consisting mainly of large ice-dribbled boulders in the valley floor and waterlaid gravel with a mingling of enormous granitic boulders at Pantops, the southeastern corner of the city. No undisputed glacial deposits are found in the valley for some distance eastward. The terminal moraine of the Rathdrum glacial lobe appears in Idaho. This lake was given the name of Lake Spokane. It was believed to receive all waters from Eastern British Columbia, western Montana and northern Idaho as far south as the St. Joe River at the southernmost extremity of Lake Coeur d'Alene. Thus it was conceived of, not as a mere melt-water marginal lake, but as a major interruption of drainage, impounding the waters flowing westward from the Continental Divide and diverting them over a low range of mountains through its outlets at Mica, twelve miles southeast of Spokane, by two channels which, when they ceased to function as a water course for a vast drainage, left a crest of 2,478 feet (bench mark at Mica). The lake level may then be assumed as about 2,500 feet A.T. at its lowest level, giving a depth of about 500 feet in the immediate vicinity of Spokane. In other words, the 2,500 feet contour line on topographic maps of Washington and northern Idaho would about mark the shoreline of this lake. This enlarged Lake Coeur d'Alene greatly.

Prior to the recognition of Lake Spokane erratic boulders as far up the Coeur d'Alene River as Kellogg, Idaho, were suspected by Hershey to have been carried in by floating ice. Attempts to place the lake border to the northeast and into Montana is only futile guessing, for a well-marked characteristic of the whole area of the lake is the presence, everywhere almost, of boulders and boulder till carried in on stranded icebergs, indicating that the glaciers and lake joined in that direction. In absence of such obstructing ice Lake Spokane would have overflowed the low divide just north of Sandpoint, Idaho, into the valley of the Kootenay River and would never have attained a level much over 2,700 feet A.T.

The Mica channels lead to Latah (Hangman) Creek Valley, which was also blocked by the glacier near Spangle. A low divide at the head of North Pine Creek permitted an overflow into North Pine Creek Valley, the final high level of this divide being just under 2,450 feet. (For recorded evidence of these levels see U. S. G. S. topographic maps, Spokane, and Oakesdale Quadrangles.) To the impounded water in the valley of Latah Creek, Dr. Bretz gave the name, Lake Latah.

In SCIENCE of September 10, 1943, Professor William H. Hobbs announces his discovery in the past summer of a Pleistocene lake in Spokane Valley to which he gives the name of Lake Spokane. Between the time of writing the article and its publication (September 10, 1943), he discovered in the *Pan American Geologist,* date 1924, a description of Lake Spokane, apparently having failed to find the earlier article in SCIENCE of 1922. Immediately on finding the earlier observations and naming of the lake, he sent compliments on "keenness of observation" but insisted the lakes were not the same because the one he had described was on a much larger scale. This larger scale lake in the same valley is determined by the finding of a delta of a creek in the basin of Lake Latah indicating a water level of 2,508 feet or 30 feet higher than the present level of the bottom of the Mica channel, and 58 feet higher than the highest present level of the North Pine Creek outlet. Neither of these channels have carried a stream of water since the melting of the ice barrier at Spokane. Hence they are, probably, near their Ice Age levels. The volume of water carried by these channels was of course the same for each pair, and considering the area drained it is fair to assume that was considerable. The comparative erosion rate can not well be estimated. It may be assumed also that each channel was deepened somewhat. In width the channels do not differ much. It would require only a depth of water of thirty feet flowing over the summit at Mica to invalidate all claim to a larger lake. A temporary ice dam in the North Pine Creek channel is not impossible but is probable. There was an abundance of floating ice. Such an obstruction in the North Pine Creek outlet of fifty-eight feet would raise the lake level enough to permit a delta of the height Dr. Hobbs found.

This North Pine Creek Valley is the eastern-most of the many "scabland channels." As there is in this channel no hint of glaciation it offers a good check on the possible effects of torrential waters which seem to be a stumbling block in Dr. Hobbs's acceptance of Dr. Bretz's explanation of the scablands. It is a miniature Grande Coulee conveniently located where the highway between Spokane, Pullman and Moscow parallels North Pine Creek, two miles north of Rosalia.

It will no doubt be interesting to have a glacialist of Dr. Hobbs' wide experience enter this field of central Washington with its still smouldering problems of the formation of the "scablands," but is unfortunate in its timing for few geologists can spare time from the war effort to reconsider these problems of great controversy of the twenties.

What seems a ground for agreement in this case is the probability that Dr. Hobbs, in his hasty survey of the area, has found evidences of an earlier and more extensive glaciation than that of the "Spokane ice" (evidence of which has not been entirely overlooked hitherto) which could be capable of producing the "anticyclone" effect which he has found in his studies in various parts of the world to be responsible for the formation of loess wherever it is found. In this case the loess deposits are the wheatlands of the Big Bend, the Pendleton and the Palouse regions. The recognition of this as the earlier glaciation of the region and of Palouse soil as loess would be in accord with our observations that the formation of the Palouse soil preceded the Spokane glaciation, as shown by the fact that there is no mantle of this soil in the North Pine Creek Valley, from which it was swept by the waters from Lake Spokane. Dr. Hobbs' westward extension of Lake Spokane as Lake Leverett seems to fit nicely as the immediate water source for the heads of Dr. Bretz's scabland channels, through which the water, 500 feet deep in Lake Spokane, was funnelled when the ice dam burst, and from Lake Missoula, 1,200 feet deep at Missoula, came, perhaps in successive floods, as the recurring periods of advance and "recession" of the glacier occupying the Purcell Trench operated the valvelike outlet at the head of Lake Pend Oreille of the waters covering a great part of western Montana.

THOMAS LARGE

SPOKANE, WASH.

EARLY HYDROGRAPHIC WORK ON AN AMERICAN LAKE

FOR many years there has been hanging in the building of the Skaneateles Library Association, Skaneateles, N. Y., a framed manuscript chart of Skaneateles Lake. It is poorly drafted to a scale of a little more than an inch to a mile, on two pieces of paper that had lain folded for years before being mounted, and has probably rarely received more than a casual glance. Recently, through the kindness of the association, particularly its librarian, Miss Alice E. Washburn, the writer was able to examine this chart more closely.

The chart was drawn up in 1824 and in 1827 by a Captain Benjamin Lee,[1] primarily on the basis of a series of soundings made by him with "deep-sea leads" made for the purpose. Apparently he made no survey of the shores or outline of the lake, for his delineation of its configuration, while vaguely correct, evidently was strongly influenced by the presumed meaning of the Indian word "Skaneateles"—"The Beautiful Squaw"[2]—and his indicated widths of the lake in places near the lakehead are twice the actual figures. The soundings, however, are quite accurate when compared with the bathymetric map of the lake prepared by the College of Engineering, Cornell University, and published by Birge and Juday in 1914.[3] Lee's chart indicates a maximum depth of 275 feet off "Nine Mile Point" (now Carpenter's Point), whereas the maximum depth, at approximately the same place, is 287 feet, according to Plate III of the paper cited (but given as 297 feet in the text, p. 537).

Curiously, through two compensating errors, Lee's estimate, contained in a manuscript note on the chart, of the volume of water in the lake is very near the figure arrived at by Birge and Juday ninety years later on the basis of far more complete and accurate data. Lee estimated the area at 20 square miles and the average depth at 100 feet, with a volume of 1,546,240,000 long tons (55,664,640,000 cubic feet). Actually the lake has an area of 13.9 square miles and a mean depth of nearly 143 feet, with a volume of 55,151,000,000 cubic feet (Birge and Juday, p. 537).[3]

Most significantly, however, Lee took bottom samples with his "deep-sea leads" and indicated on his chart, in proper nautical fashion, the character of the bottom at a number of sounding stations. The accuracy of this aspect of the chart can not be completely verified at present, for we know no more about the bottom sediments of the Finger Lakes now than in Lee's day, so far as published data are concerned. In general, except for local near-shore or shore-line deposits of sand and gravel, they are assumed to be composed of silts and muds, and from the writer's very limited investigations this generalization holds at least for the heads of Cayuga and Skaneateles lakes.[4] On Lee's chart, however, the bottom of the center of the lake at three stations between Carpenter's Point and a point a short distance south of Mandana is noted as "clean white sand." North and south of these points the bottom is indicated as muddy. This would seem to be worth checking, for even if it proved to be neither clean nor white, a sand bottom in the middle of such a lake, virtually a gigantic settling basin, is unexpected.

Lee's manuscript chart, in spite of its imperfections, is not only interesting historically, but significant scientifically because it contains data bearing on a problem that unfortunately has not yet been studied in the case of any of the Finger Lakes, namely, the nature, distribution and origin of the bottom deposits —a problem whose solution should shed much light on the late Pleistocene and Recent geological history of central New York.

JOHN W. WELLS

THE OHIO STATE UNIVERSITY

PRE-TENNYSONIAN THOUGHTS ON AIR TRANSPORTATION

IN the issue of SCIENCE for November 12, 1943, on page 431, Mr. M. F. Ashley Montagu quoted certain stanzas from "Locksley Hall," in which Tennyson anticipated aviation in its commercial and military aspects. It is thought that the following two extracts which for some time have been among my collection of clippings might be of interest to your readers in this same connection.

From the *Proceedings of the Liverpool Naturalists Field Club*—1904, page 30:

> Soon shall thy arm unconquered stream afar,
> Drag the slow barge or drive the rapid car,
> Or on wide waving wings expanded bear
> The flying chariot through the fields of air.
>
> —ERASMUS DARWIN, 1802.

In a publication by the Rockefeller Center, it was reported that George J. Atwell has brought to light the following inscription from the tombstone of Saint

---

[1] This may have been the Benjamin Lee mentioned in the ''National Cyclopedia of American Biography,'' who, after having been a minor officer in the British Navy during Revolutionary times, came to this country and entered the merchant marine as a captain. He lived in Cambridge, Mass. The chart very likely resulted from observations (for amusement?) made while visiting the pleasant, cultured village of Skaneateles.

[2] The proper rendering of Skaneateles is ''long lake'' (see H. W. Thompson, 1940, ''Body, Boots and Britches,'' Philadelphia, p. 461).

[3] E. A. Birge and C. Juday, *U. S. Bur. Fisheries Bull.*, 32: 525–609, pls. 111–115, 1914.

[4] About 27 years ago Professor G. D. Harris made several dredgings of the bottom at moderate depths near the head of Cayuga Lake in connection with the late Carlotta Maury's studies of the molluscan fauna of central New York. Fine gray mud was reported (*Nautilus*, Vol. 30, p. 32).

Francis of Paula, 1416–1508, in Kirby Cemetery in Essex, England:

> When pictures look alive with movements free;
> When ships, like fishes, swim beneath the sea;
> When men outstripping birds shall scan the sky;
> Then half the world, deep-drenched in blood, shall die!

WILLIAM H. CREW

195 BROADWAY,
NEW YORK, N. Y.

SCIENTIFIC BOOKS

PLANTS AND VITAMINS

Plants and Vitamins. By W. H. SCHOPFER, director of the Botanical Institute, University of Bern. Authorized translation by N. L. Noecker. xiv and 293 pp. Foreword by W. J. Robbins. Waltham, Mass.: The Chronica Botanica Company. New York City: G. E. Stechert and Co. 1943. $4.75.

TEN years ago no book could have been written about vitamins in plants, although plants were clearly recognized as an important source of accessory factors for human and animal nutrition. During the last decade extraordinary progress in the study of vitamins has resulted in a rich literature which supports the ambitious goal which the author of "Plants and Vitamins" has undertaken, namely, to crystallize our knowledge of vitamins in plants, to show the relations of this domain to general biochemistry and physiology and to suggest fertile areas for cultivation by future investigators. The book contains 24 chapters, an author index and a general index, and many illustrations and structural formulae of compounds.

The contents are organized into three parts. The first deals with the capacity for synthesis and the functions of vitamins in green autotrophic plants. In the second part, the author gives an extensive discussion of growth factor deficiencies in organisms which have lost the ability to synthesize vitamins. Part three presents some general phenomena which are wholly or partially explained on the basis of the vitamin concept. Well-deserved emphasis is given to the discussion of growth factors in microorganisms, because it is in this particular field that outstanding progress has been made in such a short time. Of special interest to both plant and animal physiologists are the chapters on biological synthesis and the roles of growth factors in protoplasm. The discussion of vitamins in enzyme systems could have been more extensive, and much remains to be said about competitive inhibition, sulfonic analogues, etc.

As stated by the author, his book does not by any means claim finality, but rather represents a stage of progress in research which continues to advance. Although some workers may not wholly agree with certain of the author's conclusions and the emphasis placed upon various topics, this book fills the need for a critical and authoritative appraisal of the advancement of our knowledge concerning vitamins in plants. The writing of such a book required the consultation of a very extensive bibliography. It is a matter of regret that many interesting and important contributions mentioned briefly in the discussion are not cited by specific references to the literature. It is easy, however, to forgive omissions of literature published since 1941, when one considers the difficult circumstances surrounding the author in Switzerland.

Only in the past several years have we learned that the fundamental functions of vitamins are the same in regulating the metabolism of both plants and animals. A vitamin, according to Professor Schopfer, is an "organic substance, the need for which results from the loss of the capacity for its synthesis, whose action is catalytic (active in small amounts), quantitative and markedly specific." The book indicates that at all phylogenetic levels the requirements of living matter are approximately the same regardless of the structure of the organism. The only aspects that differ are the morphological expressions to which vitamin deficiency may give rise. The author shows how vitamins constitute the meeting ground for specialized sciences, where workers in organic chemistry, enzymology, human, animal and plant physiology all meet to solve fundamental problems.

The philosophical view-point of the author is indicated in the following quotations taken from his concluding chapter:

> In order to understand the problem of vitamins in all of its ramifications it is no longer possible to confine oneself to one field. The plant physiologist has learned from his confrère, the human physiologist, what an avitaminosis and a vitamin is. The plant physiologist in turn has shown that plants are the seat of the biosynthesis of vitamins and thus has established a new intimate relationship between two kingdoms. The biochemist, by establishing the chemical structure of vitamins, has been obliged to create new groups of chemical compounds. The enzymologist finds to his surprise that these vitamins are nothing but the active portions of enzymes which have been studied for a long time. The microbiologist, who for years had been trying, without success, to isolate the "growth factors" of his microorganisms, proved that typical animal vitamins were the factors he was looking for. The concept of growth factors (in the exact sense) conforms with that of vitamins (in the strict sense) and is identical with it. . . .
>
> The problem of vitamins started with man and, in the last analysis, it returns to man after an apparent departure from him. All the progress accomplished in this domain contributes to a better understanding of the prob-

lem in general and ultimately to human well-being. To speak of the well-being of Man at this time seems to be macabre humor. Why is it that skillful men from different nations can solve problems in fundamental biology but can not do so when the matter directly concerns themselves? The question remains unanswered.

Paul R. Burkholder

Yale University

REPORTS

A DEPARTMENT OF GEOGRAPHY[1]

At least a hundred college heads have inquired as to our plans for geography in the post-war years and have invited help in the selection of personnel. This is true no less of women's colleges than of men's-colleges. It shows deep and, we hope, permanent interest in research as well as thorough-going instruction in geography. This has been one of the most neglected fields in higher education. War and its related problems of peace-time organization for equity and freedom have at last taught the American people that modern geography is not children's geography to be finished in the seventh grade. That "imaginative grasp of space" which science shares with poetry seemed somehow to have been impossible to attain until our Army, Navy and Air forces had taken their stations and begun their operations in almost every part of the world. For a full generation we seemed unable in our thinking to synchronize time and space in a spreading network of technologies, trade and international relations. "The Map and the Clock" is the significant title of a brilliant editorial published recently in the London *Times Literary Supplement.* We shall be dealing with what we once regarded as the "outer world" for a long time to come, with such speed and responsibility, and with such a practical need for wide comprehension, that we can not escape corresponding educational demands if we would.

Geographical science has a significant part to play in national policy. The conviction seems to grow that we can not safely limit our future responsibilities to narrow zones of power. No line can be established anywhere in the world that confines the interest of the United States because no line can prevent the remote from becoming the near danger. Nor can danger be wished or talked away. Positive intentions and acts based upon deep understanding of both good and evil forces are required. The Western Hemisphere conferences of the past ten years are but one of several major forms of political association. This geographical term no longer implies political separation from the rest of the world and a sheltered retreat. Interwoven with the fate of the United States are the fates of countries on the farther side of the world organized on political and social hypotheses and conditions quite different from those that prevail among ourselves.

For nearly one hundred and fifty years the philosophy of geography has included the thesis of Humboldt, that the diversified riches of the earth are a vast source of human enjoyment, and that man's highest development requires that we put the world's resources into a common world stream of understanding and use. We have become so accustomed to international trade that we are often insensible of the extent to which our comfort, our welfare and our safety depend upon the interchanges of products and ideas about them and the multiform agreements that implement their exchange.

More important still is the process of cultural interchange. If it were as free and full to-day as our exchange of products, the world, while retaining its picturesque and stimulating cultural differences, might have an agreed code of relationship and behavior with corresponding reduction of the risk of war. It will take further experience, long-continued persuasion and a determined will to bring such a code into being. Certainly ignorance and flippancy will not build a highway to this goal. We must gain experience and will power on a higher level of cultural interrelations than any we have yet known. This means knowing other peoples intimately, and gaining the ability to see their interests clearly as well as our own. Only in their natural settings can we fully understand the languages, literatures, codes, ideas, interests and moralities of peoples unlike ourselves. To give but one example, no policy of interrelated migration of people and of settlement of underdeveloped lands, no rational easement of so-called "population pressure," can be sound unless and until geographical and cultural studies are joined in the attainment of agreed purposes. Such great endeavors also require the union of the philosophical and the utilitarian, the theoretical and the practical. The result is of such profound consequence to a stable world order that it would be madness to exclude university participation. Only during the past two decades have some of our universities become aware of their long neglect of fields of inquiry and action that affect the peace or the ruin of the diverse peoples that share the planet. Once an honored part of the classical curriculum—Ptolemy, Strabo and Varenius having been almost as well and as generally known by educated men of an earlier generation as Virgil and Homer—geographical instruction declined in the nineteenth century and even at the time of World War I was limited to a relatively small number of universities.

For several years we have been giving instruction in geography at Hopkins on a modest scale. The Army Specialized Training Program has required the sudden expansion of instruction in this field at a time when it is extremely difficult to increase staff because of the prior demands of the armed services. It is gratifying to report that the faculty enthusiastically favors the development of a permanent department in the interest of both undergraduates and graduates. Willing cooperation in this enterprise is evidence of a healthy attitude toward post-war conditions which inevitably will have more of the planetary in them even if no less of the local and national.

---

[1] From the annual report of Dr. Isaiah Bowman, president of the Johns Hopkins University.

To have depth and university quality such a department must have a staff of exceptionally well-trained scholars. To secure breadth there should be active association, in this new training program, among scholars in a number of related or parallel fields.

Four young men of excellent training form the core of the department. They are Dr. Karl J. Pelzer, who has already published extensively on settlement and labor conditions in the Far East; Dr. George Carter, whose work in both geography and anthropology provides a useful link between these two fields, and who will provide specific instruction in the latter field in this university for the first time; Dr. Andrew Clark, who has had two years' field experience in the Pacific area; and Dr. Jean Gottmann, formerly of the Institut de Géographie, University of Paris, who began his association with Hopkins in April, 1943, thanks to leave from the Institute for Advanced Study, and who will join our faculty on a full-time basis on July 1, 1944.

To assist the members of the Department of Geography and to provide the requisite breadth, the cooperation of a number of scholars in allied fields has been obtained. The archeological and cultural aspects of Mediterranean geography will be developed by Dr. W. F. Albright, whose distinguished work in Near Eastern archeology and history is well known. The historical and regional geography of the Basin will be developed by Dr. Gottmann. A course on the geography of disease will be worked out cooperatively with the School of Hygiene and Public Health. The Far Eastern field will continue to have the guidance of Mr. Owen Lattimore, director of the Page School of International Relations, and more recently political adviser to the Chinese Generalissimo. The wide experience of Dr. Abel Wolman, professor of sanitary engineering, will be available for advanced work in the vital field of conservation. Associated with the department is Mr. Lloyd Brown, librarian of the Peabody Institute, who will give instruction in historical geography, a field in which he has already made notable contributions. We will also continue to have the cooperation of Dr. Ernst Cloos and other members of the Department of Geology in the training of students in physiography and meteorology. I am pleased to note also the interest and friendliness of the History Department, the English Department and others.

These interconnections are not imposed upon any department. They register the general belief that the university should enrich its program of academic instruction, not only by the addition of a formal department of geography, but also by a certain grouping of established interests and training skills in different fields of research. We shall thus have better trained men in existing departments while providing a larger number of competently trained young geographers to help staff the many new departments of geography now in the making throughout the United States.

Finally, we have a great work of conservation and development before us as a nation. We can not expect high cultural attainments on a mean or low material basis. The world is rich but its wealth is finite not infinite. The most advanced countries have been most wasteful of their patrimony. Only a few have but recently adopted more sensible conservation policies, and they have still far to go. In the colonial field we have terrible examples before us of downright failure in applying our more intensive cultural methods to native enterprise and unfamiliar tropical environments under the stimulus of commercial agriculture. It would be folly to expect every people, and especially the small and poor, to discover and adopt sound conservation practices. The leading nations have great technical staffs and vast opportunities of experimentation through mass education that smaller nations do not possess. But colonial administrators and policy-makers, to secure adequate staffs for the enlarged tasks of the future, will need far more penetrating and advanced geographical instruction than anything we have known up to this time.

A large expansion of research and of technological training is implied by such a program. A considerable amount of it will invite the participation of women as well as men. Cartography alone has been stimulated enormously by the war, and it will continue to be a major concern of enterprising government departments after the war. Through it, and its many applications, national inventories of resources may be properly taken, land registers completed, and statistical results given that environmental framework that good public administration requires. Meteorological and climatological research as well as the environmental study of disease, greatly intensified, would benefit hundreds of millions of people in areas that hitherto have had altogether inadequate services. We now see that the welfare of others is our welfare also, for without mutual advantage there is, in the long run, no advantage at all for any one.

Geographical inquiry is deeply concerned with the interplay of cultural and environmental forces. Environments are not properly appraised in terms of arithmetic only, such as statistics about soils of ascertained natural fertility, combined with statistics showing seasonal variations of rainfall and temperature. The natural aptitudes of peoples count greatly. Necessity and will also drive men to change their ways and to do the unexpected and even the uneconomic. Migrations still play their vital role. In one country of the Western Hemisphere a foreign element of 260,000 Asiatics, among a group of 6,000,000, now control certain economic activities so largely that their ejection would threaten economic ruin. The causes of such instances require identification. Post-war economic necessities will drive every country to inventory its resources and develop them more intensively, tighten economic administration, and see geographical relations more clearly than ever before. These are the indispensable preliminaries of sound national policies.

SPECIAL ARTICLES

SEROLOGICAL REACTIONS WITH AN INDIFFERENT STREPTOCOCCUS IN PRIMARY ATYPICAL PNEUMONIA[1, 2, 3]

AN indifferent streptococcus (No. 344) was isolated recently from the lung of a fatal case of primary atypical pneumonia. Convalescent sera from patients with this disease were found frequently to possess the capacity to agglutinate this bacterium, while, in most instances, agglutination did not occur with acute-phase sera from the same patients, with the sera of normal individuals or with the convalescent sera of patients with certain other acute infectious diseases. Moreover, convalescent sera from some patients with primary atypical pneumonia yielded precipitates when mixed with soluble substances extracted from this micro-organism, while control sera did not.

Streptococcus 344 was isolated by the inoculation of a suspension of tissue from a human lung into the yolk sacs of chick embryos. It was readily cultivated on blood agar or in beef infusion broth, and grew well under aerobic or anaerobic conditions. On blood agar, small, gray, coniform colonies with slightly serrated surfaces were produced. No hemolysis occurred during 48 hours' incubation on blood agar prepared from rabbit, sheep or human blood. Suspensions of this organism were not soluble in bile. Fermentation reactions, in preliminary tests, did not serve to differentiate this bacterium from other indifferent streptococci.

Bacterial suspensions for agglutination tests were prepared from 24-hour cultures in broth. The bacteria were sedimented, washed three times with saline solution, killed by heating at 56° C. for 30 minutes, and resuspended in saline solution so that the turbidity approximated No. 5 in the McFarland series. Twofold dilutions of unheated serum in saline solution were mixed with equal volumes of the suspension. The final dilutions of serum ranged from 1:10 to 1:160. Tests were not carried out with serum dilutions of less than 1:10, since it was found that the bacterial suspension often agglutinated in 1:2 and occasionally in 1:4 dilutions of normal serum. Following 2 hours at 37° C. and 18 hours at 4° C. the tubes were shaken and readings were made.

Agglutination tests were performed with sera from 101 patients with primary atypical pneumonia. Sera were obtained during the acute phase of the disease and at varying periods in convalescence. Similar tests were made with acute and convalescent sera from patients with acute respiratory infections without pneumonia, psittacosis, pneumococcus pneumonia, influenza A, scarlet fever and other severe streptococcus infections. The sera of 50 normal individuals were also tested.

The results of these tests are shown in Table 1. The convalescent sera of 55 patients with primary atypical pneumonia agglutinated streptococcus 344 at dilutions ranging from 1:10 to 1:160. On the other hand, the acute-phase sera from the same patients did not cause agglutination of this bacterium except in 3 instances, in which positive reactions occurred at 1:10 dilutions. The sera from patients with pneumococcus pneumonia were negative in this test, as were also the sera from patients with psittacosis, scarlet fever and influenza A. The convalescent sera of 2 patients with acute respiratory infections without pneumonia showed titers of 1:10. One patient with Group F minute beta hemolytic streptococcus empyema developed a serum titer of 1:40 and the serum of another patient with subacute bacterial endocarditis caused agglutination at a dilution of 1:80. All the sera from 50 normal individuals failed to produce agglutination under the conditions of this test.

In the majority of instances, positive agglutination

---

[1] From the U. S. Navy Research Unit at the Hospital of The Rockefeller Institute for Medical Research, New York, N. Y.

[2] The Bureau of Medicine and Surgery of the U. S. Navy does not necessarily undertake to endorse views and opinions which are expressed in this paper.

[3] The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and The Rockefeller Institute for Medical Research.

TABLE 1

RESULTS OF AGGLUTINATION TESTS WITH STREPTOCOCCUS 344 AND HUMAN SERA

Diagnosis	Number of patients	Serum	Agglutination titer of serum					
			< 1 : 10	1 : 10	1 : 20	1 : 40	1 : 80	1 : 160
			Number of patients with indicated titer					
Atypical pneumonia	101	Acute	82	3	0	0	0	0
		Conval.	46	31	14	4	4	2
Acute resp. infection	20	Acute	20	0	0	0	0	0
		Conval.	18	2	0	0	0	0
Psittacosis	4	Acute	4	0	0	0	0	0
		Conval.	4	0	0	0	0	0
Pneumococcus pneumonia ..	28	Acute	28	0	0	0	0	0
		Conval. ...	28	0	0	0	0	0
Influenza A	12	Acute	12	0	0	0	0	0
		Conval.	12	0	0	0	0	0
Scarlet fever*	10	Acute	10	0	0	0	0	0
		Conval.	10	0	0	0	0	0
Streptococcus† infection ...	2	Acute	1	0	0	0	0	0
		Conval.	0	0	0	1	1	0
Normal	50	....	50	0	0	0	0	0

* Scarlet fever due to Group A hemolytic streptococcus Type XIX.
† 1 patient with subacute bacterial endocarditis. 1 patient with empyema due to group F beta hemolytic streptococcus.

reactions were encountered with sera obtained during the second or third week after the onset of primary atypical pneumonia. Maximum titers were found usually during the third or fourth week, and a sharp diminution in titer frequently occurred during the fifth or sixth week. In many cases the ability of patients' sera to cause agglutination rapidly disappeared, although in some instances agglutination was still caused by sera collected 10 weeks after onset. There appeared to be a positive correlation between the severity of the illness and the development of agglutination reactions with streptococcus 344.

Soluble substances were obtained from concentrated suspensions of the streptococcus by acid extraction at 100° C. and precipitation with alcohol, after which the precipitate was dried and then taken up in saline solution. The procedure was similar to that utilized for the preparation of "M" extracts from beta-hemolytic streptococci.[4] When dilutions of water-clear extracts were mixed in capillary pipettes[5] with convalescent sera from selected patients with primary atypical pneumonia, flocculent precipitates were formed after 2 hours at 37° C. and 24 hours at 4° C. No precipitation occurred with acute-phase sera from the same patients or with normal human sera. Preliminary tests indicate that the results of this test parallel those of the agglutination test but that the precipitin method is less sensitive.

Complement fixation has not been demonstrable with convalescent sera and streptococcus 344, although tests were made with antigens which gave positive reactions in either the precipitation or the agglutination tests.

Convalescent sera which had been heated at 60° C. for thirty minutes were found to have lost almost completely their capacity to agglutinate this bacterium. Heating sera at 56° C. however did not alter the titer. Sera stored at 4° C. for 1 year still gave positive reactions. The bacterial antigen was not impaired by heating at 100° C. for 10 minutes, by 0.5 per cent. phenol, or by storage for 1 month at 4° C.

The results of the streptococcus agglutination tests were found to be correlated in many instances with the results of the cold hemagglutination test[6, 7] as well as with the results of the complement-fixation test with mouse lung antigens[8] previously described. However, an appreciable number of convalescent sera were encountered in which only one or two of these tests were positive.

In preliminary experiments the cold hemagglutinin was completely absorbed from a pool of convalescent sera by human red cells without reducing the agglutination titer against streptococcus 344. Conversely, absorption of the pool with this bacterium removed the agglutinin against itself but did not decrease the titer of cold hemagglutinins.

Recently another indifferent streptococcus (No. 9) was isolated from the lung of a second fatal case of primary atypical pneumonia. The results of both agglutination and precipitation tests with this organism were comparable to those observed with streptococcus 344.

Numerous other strains of indifferent streptococci have been isolated which resemble streptococcus 344, morphologically and culturally. These were obtained from the throats or sputa of patients with primary atypical pneumonia, as well as from persons with other acute respiratory infections without pneumonia. As yet, none of these strains has yielded results similar to those obtained with streptococcus 344 in agglutination tests. Agglutination has either failed to occur or has occurred to an equal degree in both acute-phase and convalescent sera. However, when some of these strains were extracted, it was found that soluble substances were obtained which gave results very similar to those observed in precipitation tests with streptococcus 344.

---

[4] R. C. Lancefield, *Jour. Exp. Med.*, 47: 469, 1928.

[5] H. F. Swift, A. T. Wilson and R. C. Lancefield, *Jour. Exp. Med.*, 78: 127, 1943.

[6] O. L. Peterson, T. H. Ham and M. Finland, SCIENCE, 97: 167, 1943.

[7] J. C. Turner, *Nature*, 151: 419, 1943.

[8] L. Thomas, E. C. Curnen, G. S. Mirick, J. E. Ziegler and F. L. Horsfall, Jr., *Proc. Soc. Exp. Biol. and Med.*, 52: 121, 1943.

There is as yet no satisfactory explanation for the positive serological reactions which have been observed with streptococcus 344. The available evidence does not warrant the conclusion that this bacterium is a factor in the etiology of primary atypical pneumonia.

LEWIS THOMAS, LT.
GEORGE S. MIRICK, LT.
EDWARD C. CURNEN, LT.
JAMES E. ZIEGLER, JR., LT.
FRANK L. HORSFALL, JR., LT. COMMANDER
U. S. NAVAL RESERVE

THE ADRENALS AND SUSCEPTIBILITY TO TRANSPLANTED LEUKEMIA OF RATS

IT was demonstrated some years ago by Jaffe[1] that removal of the adrenals was followed by regeneration of the thymus in old rats and a stimulation of the gland in young rats. A transplantable lymphatic leukemia under investigation in this laboratory has as its most characteristic manifestation an extensive infiltration of the thymus.[2] In the investigation to be reported, the effect of adrenalectomy with its accompanying stimulation of the thymus has been tested on the susceptibility of rats to inoculated leukemia.

Two groups of experiments have been completed. The object of the first was to determine the result of adrenalectomy on the leukemia susceptibility of middle age rats, this being an age when normally the thymus has almost completely atrophied. Even the most receptive strain of rats at this age show a natural resistance, as illustrated by the fact that only 46.9 per cent. of 32 inoculated animals developed the disease. As a contrast to this, rats of the same age and strain subjected to adrenalectomy 15 days before inoculation developed leukemia in 90.3 per cent. of the 31 rats included in the group. The average survival time of the intact rats with the disease was 9.7 day, whereas the adrenalectomized animals averaged only 6.2 day.

In the second group of experiments tests were made of the effect of adrenalectomy on induced resistance of young rats. This state may be brought about by the injection of homologous defibrinated blood two weeks prior to inoculation.[3] In experiments involving 250 rats the following results were recorded. Intact young rats which received the blood injection alone developed leukemia in only 33.9 per cent. of the 59 inoculated. Among the 43 rats adrenalectomized before the injection of defibrinated blood 76.8 per cent. were susceptible and in 42 rats subjected to the reverse procedure, *i.e.,* the blood injection preceding the removal of the adrenals, 92.9 per cent. developed the disease following inoculation. Control rats which received no treatment before inoculation were 96.5 per cent. receptive, and untreated adrenalectomized inoculated rats all died of the disease.

Certain hormones are known to influence malignant conditions in such organs as are normally subject to control by the individual hormone. While in general it is not justifiable to draw conclusions as to the origin of a malignant state from results of a study of transplantation, yet in the present case it may not be amiss to call attention to the fact that the activity of the lymphoid tissue can be influenced by hormones. Therefore it is not unlikely that such hormones play a rôle in the malignant condition of this tissue, and this likelihood is suggested by the reported results. More direct evidence of this possibility is being accumulated from an extension of the investigation.

JAMES B. MURPHY
ERNEST STURM
ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

LOW LIGHT INTENSITY AND COTTON BOLL-SHEDDING

MANY reasons have been given for the shedding of flower buds (squares) and immature bolls by the cotton plant. Aside from insect injury, such factors as drought, fluctuations in soil moisture, impaired fertilization in the flower and load of fruit on the plants have all been shown to be related to the problem of excessive shedding. The studies of Mason[1] in the West Indies and those of Knight[2] in the Sudan, as well as the paper by Canney,[3] suggest that periods of cloudy weather may have considerable effect on the fruiting and shedding of cotton.

In studying the causes of shedding in cotton, recent experiments at the Texas Agricultural Experiment Station indicate that interruptions for two or three days in the high sunlight intensities often causes undue shedding of fruiting forms. For example, upland cotton plants in jars of soil two months after planting were subjected to low daylight intensity of around 50-foot candles by keeping the plants in a laboratory room for a single 4-day period. Five weeks later, these plants had on the average only 5.4 good-sized bolls per plant and each plant had shed an average of 30 squares and young bolls. At the same time, the control plants had 21.2 bolls per plant with only 17.5 squares and bolls shed. This represents a reduction of 75 per cent. in the number of mature bolls, associated with the low light intensity treatment. Most of those fruiting forms were shed during the third and fourth days while the plants were indoors. Similar increases in rates of shedding have been obtained by shading cotton plants in the greenhouse and in the field with black cloth. Such shading has reduced the direct sunlight intensity at midday from around 12,000 foot candles to 300–1,000 foot candles. In connection with these studies at College Station, light intensities of less than 1,000 foot candles have been measured at noon on cloudy days during the growing season for cotton.

---

[1] H. L. Jaffe, *Jour. Exper. Med.,* 40: 325–342, 1924; 40: 619–625, 1924; 40: 753–760, 1924.

[2] J. B. Murphy and E. Sturm, *Cancer Research,* 1: 379–383, 1941.

[3] E. Sturm, *Cancer Research,* 1: 627–628, 1941.

[1] T. G. Mason, *Annals Bot.,* 36: 457–484, 1922.

[2] R. L. Knight, *Empire Jour. Exp. Agr.,* 3: 31–40, 1935.

[3] E. E. Canney, *Shirley Inst. Memoirs,* 2: 281–290, 1924.

In addition to the abscission of young bolls just after flowering, at which stage most of the shedding in the field takes place, these low light intensities for as short a period as two days caused the shedding of many cotton squares. These effects are equal to results obtained by prolonged severe wilting, which is recognized as providing a strong stimulus for shedding. Presumably, the accelerated rates of shedding following shading were associated with interrupted photosynthetic activity and low carbohydrate nutrition. Increased vegetative growth followed the shedding of buds and bolls.

Evidence of varietal differences in the response of cotton to conditions of low light intensity has been obtained.

A. A. DUNLAP

AGRICULTURAL EXPERIMENT STATION,
AGRICULTURAL AND MECHANICAL COLLEGE
OF TEXAS

SCIENTIFIC APPARATUS AND LABORATORY METHODS

USE OF ENZYMES TO IMPROVE CYTOLOGICAL TECHNIQUES

DURING the last few years cytological studies on a tetraploid form of *Lilium longiflorum* Thunb. have been in progress at the Plant Industry Station, Beltsville, Md. It was found very difficult to analyze chromosome associations during the first meiotic metaphase because they tended to form clumps. To overcome this difficulty a number of treatments designed to digest the cell wall and destroy the gel properties of the cytoplasm were used. If this could be accomplished without injury to the paired chromosomes, well-spread figures could be secured in which analysis of polyvalents would be possible. Among the treatments herein described, several with enzymes gave definitely beneficial results.

The plants used for these experiments were a tetraploid clon of *Lilium longiflorum*, several diploid forms of the same species and a triploid clon of *L. tigrinum* Ker Gawler. Buds were collected in which most of the pollen mother cells were at the first meiotic metaphase. The perianth segments were removed and the buds then fixed in a solution composed of 3 parts absolute alcohol to 1 part glacial acetic acid. After overnight immersion the buds were run through 95 per cent. alcohol to 70 per cent., where they were held until wanted.

The anthers, as needed, were cut into small pieces, about 1 to 2 mm long, thus making it possible to give a series of different treatments to portions of the same anther. All slides were stained with aceto-carmine.

In the first series of tests only inorganic chemical treatments were used. These were: a cellulose solvent, copper oxide ammonia; a pectin solvent, 1 per cent. ammonium oxalate; and a suberin solvent, 10 per cent. alcoholic potassium hydroxide. All the slides from the treatments were poor in comparison with the untreated.

These unsatisfactory results led us to try a biological approach, and 1 per cent. solutions of three enzyme preparations were tried: Malt diastase; Polyzime "P," which is used in desizing fabrics; and Clarase,[1] a proprietary enzyme complex. For these treatments the fixed anthers were first run through lower strengths of alcohol to water and thoroughly washed. Use of the first two preparations produced little if any benefit in comparison with the check slide which in this instance was made following the washing in water. The Clarase treatment, however, brought about a partial softening of the cell walls and digestion of the cytoplasm so that in most cells the paired chromosomes were well spread out, thus making it possible to determine the types of chromosome associations present. Several periods of exposure were tried and as little as 15 to 20 minutes was about as effective as several hours.

Since the diastatic enzymes were ineffective it was thought that possibly the beneficial effects of Clarase might be caused by a proteolytic enzyme. Accordingly, 1 per cent. solutions of pancreatin (supplied by the makers of Clarase), and of papain were used. Both preparations were ineffective, and actually caused chromosome clumping. The results were very poor when compared with the checks.

---

[1] Manufactured by the Takamine Laboratory, Clifton, N. J.

Recent studies by Greathouse, Klemme and Barker[2] on the deterioration of cellulose by fungi, suggested that certain of these organisms might be of value in the present problem. Fortunately we were able to secure cultures of *Aspergillus niger* Van Tieghem, *Chaetomium globosum* Kunze, and a species of *Metarrhizium* through the courtesy of G. A. Greathouse of this Bureau. Single flask cultures were extracted 10 to 15 days after inoculation by grinding the contents of the flask with quartz sand in a mortar containing 10 ml of a sodium acetate buffer, pH 5.0. The supernatant liquid was tested on anther sections as previously described for the enzymes. This series of treatments also included a 5 per cent. solution of Clarase in sodium acetate at pH 5.0. All treatments gave beneficial results and produced slides superior to the checks. The cell walls of most pollen mother cells were softened and the cytoplasm partially digested. As a result of these changes the cells were easily flattened and the chromosomes spread. Tests were also made in which the freshly prepared Clarase solution and fungus extracts were heated to boiling prior to use. The slides resulting from material treated in the boiled solutions were definitely inferior to those from the unheated solutions, which indicates that active enzymes were necessary to produce the beneficial effect.

The results herein briefly reported are preliminary to further work under way with other treatments and modes of application. There are many aspects of the problem needing further investigation. For instance, it is not possible as yet to measure the concentration of the fungus extracts used, or to identify the enzyme or enzyme complex that is effective. So far the method has been used on only one species other than Lilium. Dr. A. E. Clarke of this division has used Clarase on the pollen mother cells of an amphidiploid Allium with beneficial results. Some observations have also been made on smears of treated Lilium root tips. These have shown that fungus extracts affect the middle lamella so that the cells separate readily. Further investigations of pre-treated root-tip smears are under way.

Neil W. Stuart
S. L. Emsweller

Bureau of Plant Industry,
Soils and Agricultural Engineering,
U. S. Department of Agriculture,
Beltsville, Md.

---

[2] G. A. Greathouse, D. E. Klemme and H. D. Barker, *Ind. and Eng. Chem. Anal. Ed.*, 14: 614–620, 1942.

A NYLON BLOOD AND PLASMA FILTER

For the last nine months we ran laboratory tests on Nylon blood and plasma filters. Our observations and tests fully coincided with those made by Dr. S. Brandt Rose, *et al.*, as reported in Science (Vol. 98, No. 2534).

However, we found the sewing of these tiny filters rather cumbersome, and noted that small, but objectionable quantities of Nylon fibers would be entrained in the filtrate.

We took advantage of the thermo-plastic qualities of Nylon and welded the seams rather than sewing them. This method is much faster than sewing and eliminates the shedding of Nylon fibers. Furthermore, the filters can be fabricated with a cone point, and thereby can be utilized for making the drip count.

The following method was found to be satisfactory in making the filters: A double layer of finely textured Nylon cloth was placed on a flat metallic surface. A sheet metal template was made for the filters, and this was placed firmly over the Nylon cloth. The outline of the template was then traced with an electrically heated metal stylus. The stylus of an electric wood-burning set was used for this with excellent results. Flat, colorless, flexible seams were obtained after only a small amount of practice. These seams were tested carefully and were found to be safer for use in transfusion filters than sewn ones.

Prior to using the electric cutting method, experiments with flame cutting were conducted, but the results were found to be too unreliable.

The filters were welded directly to the glass delivery tube of the transfusion assembly.

Some chemical tests were made on the Nylon material. It was found to be soluble in mineral acids and was destroyed by alkalies. It withstood treatment with hydrogen peroxide and solutions of sodium citrate and sodium citrate-dextrose.

The apparatus was developed in the laboratory only, and was not used in giving transfusions to patients.

Elizabeth Glaser
Los Angeles, Calif.

BOOKS RECEIVED

Cross, Roy. *From a Chemist's Diary.* Illustrated. Pp. 315. Kansas City Testing Laboratory, Kansas City, Missouri.

Huff, Clay G. *A Manual of Medical Parasitology.* Illustrated. Pp. x + 88. The University of Chicago Press. $1.50.

Middleton, L. R. *A Textbook of Light.* Illustrated. Pp. viii + 288. G. Bell and Sons, Ltd.

Smart, John. *A Handbook for the Identification of Insects of Medical Importance.* Illustrated. Pp. x + 225. British Museum (Natural History). 15 shillings.

Stout, William B. and Franklin M. Reck. *Tomorrow We Fly.* Pp. 160. Thomas Y. Crowell Company. $2.00.

Thorndike, Edward Lee. *Man and His Works.* Pp. 212. Harvard University Press. $2.50.

SCIENCE

VOL. 98 FRIDAY, DECEMBER 31, 1943 No. 2557

The Kilgore Bill: DR. VANNEVAR BUSH 571

Obituary:

Recent Deaths 578

Scientific Events:

The Entomological Society of America; The American Society of Tropical Medicine; The New York Academy of Sciences; The Institute of Radio Engineers; The Fiftieth Anniversary of the Army Medical School; Officers of the American Chemical Society; Award of the Edison Medal to Dr. Vannevar Bush 578

Scientific Notes and News 581

Discussion:

Gigantic Drying Cracks in Animas Valley, New Mexico: WALTER B. LANG. *Pollen Record of Canadian Spruce and Fir from Texas Bog:* PROFESSOR J. E. POTZGER and PROFESSOR B. C. THARP. *A Forgotten Factor in Cardiac Physiology:* DR. O. S. GIBBS. *A Catalogue of Insecticides and Fungicides:* PROFESSOR DONALD E. H. FREAR. *The Giant Sequoia:* PROFESSOR EDWARD W. BERRY 583

Scientific Books:

Organic Chemistry: DR. MARSTON T. BOGERT. *The Electrical Industry:* DR. S. REID WARREN, JR. 586

Special Articles:

Purification and Character of the Swine Influenza Virus: DR. J. W. BEARD and OTHERS. *Decrease in Lactic Acid Content of the Brain in Poliomyelitis:* DR. HERMAN KABAT and OTHERS 587

Scientific Apparatus and Laboratory Methods:

A Rapid Iron Hematoxylin Tissue Stain for Routine Laboratory Use: DR. HERBERT S. KUPPERMAN and DR. CHARLES R. NOBACK. *A Myotome for Biopsy of Muscle:* LIEUTENANT ROBERT E. SHANK and DR. CHARLES L. HOAGLAND 591

Science News 8

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL; WARE CATTELL, assistant editor. Published every Friday by

THE SCIENCE PRESS
Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

THE KILGORE BILL[1]

By Dr. VANNEVAR BUSH

DIRECTOR OF THE OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT

As I promised in my letter of August 18, I am now writing you a further letter in regard to S. 702. It is a long letter, for I have commented not only on the bill itself, but also more broadly on the general subject, in the attempt to give you my thoughts in a constructive manner. These comments apply not only to S. 702 but also to its companion bill, H.R. 2100, which was introduced by Mr. Patman on March 5, 1943, and was referred to the House of Representatives Committee on Patents.

This problem that we both have been studying is exceedingly important. Since it may well involve the future health, comfort and safety of this nation to an extraordinary degree, its importance warrants all the effort which you and your committee have been devoting to it.

It has two phases. One is the appropriate organization of science and technology for the prosecution of the war. The second is the corresponding problem in times of peace.

In my opinion, these two phases can not be treated as a unit. In times of war this great democracy does many things that are aimed at a relatively brief intense effort. We centralize authority, subject ourselves to rationing and restraints and send our sons to fight under the necessary rigors of military organization. Events have already shown that a democracy which thus girds itself for war can contend successfully with the most rigid of totalitarian states. In fact, it can overcome them, for the resourcefulness, initiative and self-reliance which are engendered in a people by the privileges of democracy, when marshalled under a temporary authoritative war organization, can surpass by far the performance of any permanently regimented people in the complexities and technicalities of modern war. We have already proved this in Africa, in the Far East and over Europe, and we will prove it again and again as the war progresses.

---

[1] Letter to the Honorable H. M. Kilgore, United States Senate, Washington, D. C.

I trust that we as a people will never forget what we have learned and are learning during this war period.

Thus, in time of war, I believe in a centralized control, and I believe such control can appropriately be applied to science and its applications, if every effort is made in the process to preserve the independence of action of scientific and technical groups within their assigned spheres of action to the maximum possible extent. This has been the philosophy of the Office of Scientific Research and Development, and the record will show that it has been successful in its fields of development of new weapons and military medicine.

As applied to the war period, S. 702 seems to have four major objectives. First of all, it would alter the existing administrative organization of scientific activities by setting up an Office of Scientific and Technical Mobilization having the powers specified in Section 4 of the bill. Secondly, it would further amend the provisions of the Selective Training and Service Act of 1940, as amended, by setting up a separate procedure for the granting of occupational deferments to people having scientific or technical training and experience. Thirdly, the administrator of the Office of Scientific and Technical Mobilization would be given certain powers with respect to the requisitioning of scientific and technical facilities during the war. Lastly, the bill would vest in the Office of Scientific and Technical Mobilization very broad and far-reaching patent rights. I think that it may be helpful for you to have my comments on and reactions to each of those wartime objectives.

As I pointed out in some detail in my letter to you (dated December 7, 1942) commenting on the bill (S. 2721) that you introduced at the last Congressional session, there is an adequate existing administrative setup handling the necessary scientific war activities. Under Executive Order 8807, the President granted rather broad powers to OSRD, a temporary war agency, concerning the planning, coordination, initiation and support of scientific and medical national defense research activities. These powers have been carefully scrutinized for the past several years by the Congressional appropriation committees, and the Congress has seen fit to finance OSRD's operations by providing the necessary appropriations. Acting under that authority provided by the President and the Congress, OSRD has become the keystone of a closely integrated, highly cooperative organization of war research and development work for the Armed Services. That such an organization has been and is successful is best evidenced by the great confidence shown in it by the Armed Services and by the extremely important results that have been achieved.

It seems to me that it would be ill-advised and dangerous to throw a "monkey wrench" into such finely meshed machinery at this late date by such a major administrative change as is reflected in S. 702. Because of the inevitable disruption and confusion that would result from such a major organizational change, it seems to me that the Congress might better concentrate its efforts on remedying any flaws that you may find in our existing organization rather than attempt to superimpose an over-all organization at this late date in the war period.

The second major wartime change reflected in S. 702 concerns the better utilization of our scientific personnel by amending the Selective Service Act. Subject to that Act and all the powers and regulations of the War Manpower Commission, OSRD has mobilized a large percentage of the best qualified scientists and technicians of the country, primarily by means of the execution of contracts with educational institutions and industrial organizations whereunder specific war projects are conducted. However, OSRD's powers concerning the utilization of scientific personnel in war work have not included any authority to affect in any way the operations of the Selective Service System by controlling generally the disposition and utilization of men having scientific and technical training. The relationship of our scientific manpower to the Selective Service procedure has not, in my opinion, been clearly defined, and the procedure for ensuring that men of this special training are used to full advantage in places where their talents could best further the war effort has been ineffective. It seems to me that the prosecution of modern war requires the treatment of scientific men as a special group to be specially allocated for work in the fighting services and in civilian research, and that this can not be done adequately under the present procedures of the Selective Service System. There is no question here of shielding a special class against the rigors of war. It is rather the question of the intelligent use of a great nation's asset. The young men who make up this group should be under orders to serve where needed and, if the public interest indicates that they should remain in the laboratory rather than serve in the field, they should be retained in the laboratory. Likewise, when they are needed in the field they should be transferred there under orders to share the combat hazards with the members of the Armed Services in performing their duties. In other words, the scientific group should have their own selective service system, adapted to placing them exactly where needed.

My comments on this point are not intended to be in criticism of the efforts of the present Selective Service System because my point is directed rather to the legislative basis on which they operate. As a matter of fact, in spite of its inherent difficulty, much progress has been made on the job by the cooperation between the various governmental agencies involved. The problem is far from solved, however, and even at this late date I think that it would be advisable to enact legislation placing the matter on a firm basis. Therefore, I suggest that the Congress might well consider Section 5 of S. 702 along with other pending legislation affecting the operations of the Selective Service System in order to work out as soon as possible a solution to this problem that is consistent with the solution to other manpower problems.

Concerning that part of S. 702 dealing with the requisitioning of scientific and technical facilities needed by the Government for war purposes, it seems to me that no such legislation is needed because the present patent and war emergency laws are adequate for the purpose. Under existing legislation, the Government has the right to requisition facilities and to use patents needed for war purposes in cases where it is not possible to negotiate with the owners. Although such power is now available for use, it has been the experience of OSRD that it is necessary to exercise such powers only in the most exceptional cases. As a whole, we have found the owners of facilities and patent rights to be more than willing to turn over the use of their property to the Government for war work on a reasonable basis.

The last point covered by S. 702 in wartime concerns the vesting in the Government of certain patent rights. On this point, I think that it is important for you and your committee to consider the possible effects of such legislation on the prosecution of the war. Since the declaration of the National Emergency on May 27, 1941, the Government has entered into thousands of contracts calling for work in connection with the development and improvement of war weapons. At least in the case of OSRD, all research and development work has been done under such contracts on a non-profit basis, both by educational institutions and commercial organizations. In handling inventions made by commercial organizations under its contracts, OSRD has followed the lead of the Army and Navy by providing in the contracts that the Government shall receive a royalty-free license to such inventions for specified purposes and that the title to such inventions shall vest in the contractors. In a great many such cases, of course, the contractors concerned have worked for many years, spent considerable sums of money and accumulated many patent rights before they arrived at the point of development reached at the time of the execution of their first Government contracts. Thus, work under government contracts frequently involves only minor adaptations of past inventions made by the contractors, and in such cases the contribution to the final product attributable to the work financed by the Government is relatively insignificant. In all such cases the Government has followed the theory that it should pay reasonable royalties for the use of inventions made prior to the Government contract and should receive only a royalty-free license for developments made under a Government contract.

The theory expressed in Section 7 of S. 702 constitutes a radical departure from the theory heretofore followed by the Government in dealing with war contractors concerning patent rights. I think that it is important to recognize the fact that such a radical departure undoubtedly will be vigorously fought by those persons and organizations opposed to the theory that the Government should be the owner and custodian of all inventions made since May 27, 1941, under contracts or other arrangements whereby the Government has contributed "any money, credit, physical facilities, or personnel." Even though provision is made for the payment of fair and just compensation for the seizure of such property rights, there will be many who will protest that the Government has broken faith with those who have relied upon equitable contractual agreements entered into in good faith by organizations whose primary purpose has been to make more effective the prosecution of the war. It is my considered judgment that the storm of controversy that would arise upon the enactment of such far-sweeping legislation, especially from those large commercial organizations whose complete cooperation and attention is vitally needed in the war program, would do irreparable harm to the united and concerted program for the development, improvement and utilization of war weapons that is now being carried on so effectively. Therefore, I suggest that consideration of a radical departure from the present governmental system of handling patent rights at least be deferred until after the war is won and that it then be made the subject of very careful study before action is taken.

On the general question of the advisability of such patent legislation, I wish to point out that the President has appointed a Patent Planning Commission which has been working on this general problem for some time. I regard the first report of the commission as being a valuable step toward effectuating certain advisable changes in our patent system, and I understand that the commission is now at work on a second report dealing with the problem of Government ownership of patent rights. In view of the complexity of the problem, I believe that it is advisable to await the results of the commission's study before any attempt is made to enact legislation.

My personal views concerning our patent system have been expressed before the Temporary National Economic Committee, but perhaps it will be helpful to summarize them here. In my opinion, one of the primary factors bringing about our extraordinary technical advancement and our high standard of living has been the fact that this country has had a sound patent system stemming from the Constitution. That system now needs some revision in order to make it consistent with modern conditions and to benefit from our past experience. Any such revision, however, should be made deliberately and with great care so that the fundamentals which have proved so valuable to the country over a long period of time are not injured. I believe that it is essential to the health of our industrial life for us to have a constant influx of new, small and aggressive companies, and our sound patent system up to date has made possible the advent of such companies. Thus, it seems to me that basically our present patent system furthers the public interest.

Of course, it is inevitable that over a period of time the Government should accumulate a large number of patent rights, especially considering the present number of Government employees and Government contracts providing for such acquisition. I agree with other commentators that at the present time we have no fully adequate method of handling such patent rights for the full benefit of the public, and I am in complete sympathy with the attempts of the Patent Planning Commission to work out a uniform administration applicable to all Government agencies that will be in the best public interest. However, inasmuch as the patent system problems cover many issues that are complicated by war conditions and are quite unrelated to the general scope of S. 702, I think that the problem requires separate legislative treatment and full consideration by all the Congressional committees having jurisdiction over patent problems.

Summarizing my views on the wartime aspects of S. 702, it seems to me that (i) the proposed administrative changes are undesirable and would be detrimental to the effective prosecution of the war, (ii) the proposed requisitioning power covering scientific facilities is not needed, (iii) the proposed change in the Selective Service System concerning scientists and technicians should be considered carefully by all the Congressional committees studying the manpower problem, and (iv) the proposed changes affecting inventions and patent rights should not be made during wartime because it would be a source of confusion and dissatisfaction that would be harmful to the war effort, but certain such proposals might profitably be referred to the Senate and House Committees on Patents for consideration along with other suggestions concerning the improvement of our patent system. Thus, I conclude that no over-all legislation of the type embodied in S. 702 is needed at this time concerning the organization of scientists in connection with the war effort.

That leads me to approach S. 702 from the standpoint of studying its proposals concerning the appropriate peace-time organization by the Government of the scientific affairs of the country. This aspect is fully as important as the first, especially since we are getting along reasonably well in applying science to the war effort, and it is important for the prosperity and safety of the country that equally successful relations between the Federal Government and the scientists be maintained in the years of peace to come.

You and I have in view the same end; namely, the best furtherance of science for the benefit of the country. Although we may differ in our analysis of the methods to be followed in achieving that objective, I think that the matter is of such importance that it should be studied from every angle and every shadow of thought explored in an attempt to reach the best solution. It is in what I think is a spirit of constructive criticism that I find myself in disagreement with details of the peacetime aspects of S. 702 and even more strongly with the underlying philosophy upon which they are formulated. I am in agreement with other aspects of the bill, however, and I shall attempt to emphasize these and point out the means which my experience in science and Government leads me to believe will form the basis for beneficial legislation.

Before discussing the effect of the proposed legislation on different scientific groups, it seems advisable to point out that my analysis is based on the assumption that "all agencies and departments of the Federal Government," as used in Section 4 (f) of S. 702, means "all agencies (of the Federal Government) and departments of the Federal Government." If a broader meaning is intended under which the power of coordination given to the Office of Scientific and Technical Mobilization would extend to non-governmental agencies as well as agencies of the Federal Government, many of the comments which I shall set forth below would be quite different. The question of interpreting properly the quoted words brings up what I think is a fundamental inconsistency between the extremely broad purposes set out in Section 1 of S. 702 and the much more limited powers that would be given to the Office of Scientific and Technical Mobilization under Section 4 in order "To effectuate the purposes of this Act, . . ." It seems to me that this inconsistency should be recognized by a narrower definition of the purposes of the Act.

There are three great groups of scientific and technical men in this country: those in public service, those in industry and those in universities and non-profit independent scientific institutions. In considering the need for central control over science by the Federal Government beyond that which existed prior to the war, it is necessary to examine and analyze these three groups separately.

We should, of course, continue scientific activities on the part of agencies and departments of the Federal Government, and the Congress should support such activities generously because there are many phases of scientific work that can best be done by men in the Government service. As a nation we can be proud of the accomplishments of many of our Government laboratories, such as the Bureau of Standards, the Public Health Service, several of the Department of Agriculture laboratories, and so on. In the past there have been several proposals to centralize all government scientific work in a single department, possibly making this a new Department of Science with cabinet representation. This idea is attractive to many, especially as it would seem to give an added recognition and support to science in Government departments. There are, however, several disadvantages to such a full unification of governmental scientific effort that should be weighed carefully before any such move is effected.

The greatest difficulty would lie in divorcing each separate Government scientific effort from close association with the department most interested in its work. For example, the scientific work of the Bureau of Entomology and Plant Quarantine, the Bureau of Agricultural Chemistry and Engineering, and other such bureaus, are almost inseparably connected with the work of the Department of Agriculture as a whole. Similarly, the Geological Survey derives strength by being a part of the Department of the Interior. Examples of this sort could be multiplied. I am sure that centralized control by a new independent agency of all scientific work in Government departments would be strongly resisted. Certainly the War and the Navy Departments would insist that they control absolutely the secret work on new weapons which they conduct in their own laboratories in times of peace, much as they might be willing to supplement their own activities by requesting and receiving help from the universities, industry and other governmental laboratories. Therefore, I have come to the conclusion that it would be difficult to gather all science activities of the Government into one organization without serious sacrifice. As a matter of fact, I judge that you have reached the same conclusion because I do not find any such complete integration of governmental research in the bill.

In *Section 4 (f)*, however, I do find a provision for the coordination of the governmental research activities of the various federal agencies and departments. This, I judge, is not intended to imply either power to direct or power to control, independent of the heads of departments and agencies, but rather a central scientific clearing house set up for the interchange of data and plans in order to prevent overlapping and to facilitate that cross-fertilization of scientific effort which is often highly valuable. I have long thought that a body set up for this explicit purpose might perform a very useful function. It should certainly have joined with it an advisory scientific group, drawn on a voluntary basis from the best qualified scientific personnel of the country. There has been an increasing tendency in recent years, much to be welcomed, for individual bureaus to establish such advisory groups for their own purposes. They have often acted as reviewing bodies for the heads of the departments concerned, and their influence has been important and beneficial. A central body would form a desirable linkage between these.

In passing, allow me to present a thought in this connection which is not a part of the bill, but which is allied with this matter. I have often wondered that the Congress and its committees do not avail themselves more freely of the advice of the scientists of the country. True, the Congress has available all the scientific men in the executive departments for aid when it approaches a problem of scientific nature, but it does not often call upon more widely constituted groups. The departments and agencies often seek advice in this manner, turning usually to the National Academy of Sciences, which was constituted by Congress for this explicit purpose. Some agencies, notably the National Advisory Committee for Aeronautics, include scientific men in their organizations who serve on a voluntary basis, and I think that all will agree that this has worked well in the case of the N.A.C.A. But the committees of Congress themselves seldom use the scientists of the country directly, much as these men are willing to thus contribute their services voluntarily to their country's welfare and interests, and I feel that this could be done to advantage.

It may well be asked, how does one select scientists for this and similar purposes, in order to be sure of their ability and disinterestedness. Such a question is pertinent to a discussion of the bill, for I feel that its provisions for the selection of the necessary scientific personnel are not adequate for ensuring the services of men of the necessary caliber.

There is only one sound criterion for estimating the standing and capability of a man of science, and that is the evaluation of the way in which he is regarded by his colleagues in his profession. If there were only one way of doing this, perhaps it might not suffice, but there are many. Membership in scientific societies of standing is important, wherever such membership is dependent upon evaluation and election. Recognition by learned bodies is a guide. There are even lists of outstanding scientists, prepared by taking ballots among scientists themselves. Some of the scientific bodies, notably the National Academy of Sciences, have the recognition of the Congress in their charters. The American Association for the Advancement of Science, through a carefully prepared system of representation, integrates the large membership in very many scientific organizations throughout the country. It seems to me that some of this existing machinery should be utilized in the procedure of selecting representative scientists for a governmental purpose in order to select representative men having the confidence of scientists generally. It can safely be assumed that men selected for eminence in science by scientists themselves will also generally be disinterested, for men can very seldom rise to real prominence in science in the estimation of their colleagues unless they place science itself first in the ordering of their professional careers.

In reviewing the bill, and in thinking of post-war scientific organization generally, I believe this point is important, and it seems to me that the present provisions in the bill for securing the services of scientists in the contemplated organization are not designed to secure the best men possible. Furthermore, these same comments apply to the membership of the so-called National Scientific and Technical Board and the Advisory Committee.

My summary, then, so far as this first group of Government scientists is concerned, is that the bill does not now provide adequately for the correlation of their efforts, that it would be inadvisable to extend the bill to the point where unitary control of all governmental research would be exerted, but that there is an opportunity in this field for beneficial correlation of effort.

The second group of scientists and technical men to be considered are in the research laboratories of industrial organizations. There are over two thousand such laboratories, large and small, and their work is of great importance, particularly in view of the growing tendency in this country among large industrial laboratories to carry on research of a fundamental scientific nature and to publish the results.

During the war these industrial laboratories have been of great importance in the development of weapons, working under contracts with the Army, the Navy and the Office of Scientific Research and Development. As far as the latter is concerned I can testify that we have had effective cooperation from the group at every point, that they have accomplished results of great importance, and that with negligible exceptions they have decidedly placed the interests of the country first and have not allowed their commercial interests to interfere with their contributions to the general cause. I have already discussed the provisions of the bill that would alter in several ways the relationship of these laboratories to government in the prosecution of research on new weapons during the war, and I have noted that I do not feel that new legislation is needed for this purpose.

The position of this group of scientists under the bill during the post-war period is hence the primary point for consideration. As I interpret the bill, they would not be greatly affected because most of the clauses which would alter their relationships are limited to the duration of a state of war. Presumably, the funds of the new office would be used, in times of peace, either to construct and operate new governmental laboratories or to utilize the facilities of existing laboratories under contract. While some industrial units might elect to operate their laboratories in that way, the chances are that in time of peace most industrial units would not wish to perform any substantial amount of their scientific work under government contract, especially considering some of the provisions in S. 702 concerning patent rights. Furthermore, I doubt if these industrial laboratories would accept in peace-time contracts consistent with the OSRD nonprofit theory as applied to research and development contracts. The alternative of including a large profit under the contracts, in the attempt to enlist the voluntary participation of these laboratories in a peace-time plan, is certainly not an attractive procedure.

As a matter of general policy, I do not believe that it would be wise for government to attempt to control the operations of these industrial laboratories, as might possibly be implied in the purpose specified in Section 1 (4), although presumably not within the scope of the powers and duties that would be given the new office. The industrial laboratories form an integral part of the industries with which they are associated, and form a part of the mechanism by which units in a single industry, and entire industries, compete with one another. Moreover, their particular part in such competition is directed explicitly toward the provision of better products for public consumption. The maintenance of such an atmosphere of competition, as opposed to close government regulation of monopolistic combinations engaged in manufacturing the products which the public needs, has been the philosophy behind a large amount of legislation during the past generation, and I believe that such a philosophy is in the public interest. Undoubtedly our laws regarding trade combinations can be improved, or at least clarified, in order to render the system more fully beneficial, but the general idea of having various units in an industry competing on the basis of which one can supply the public with the best goods at the lowest cost, is hard to improve upon in theory, and in general it has worked well in practice wherever it has been truly operative. The industrial laboratories are an essential part of this process, and I feel that they should be subjected to as little centralized control as possible.

That brings us to a consideration of the proposed post-war effects of the bill on the third class of scientists; namely, those in universities and non-profit independent scientific institutions, and it seems to me that this group may be primarily affected.

In time of war it seems to me that the public interest demands that this group should be closely organized in order to apply their accumulated scientific knowledge to the direct needs of the Armed Services for developing new weapons and equipment and for meeting the needs of military medicine, and this organization has been accomplished by the Office of Scientific Research and Development, a war agency. Although such organization is necessary in time of war, it seems to me that in time of peace the scientists in this group should be given a maximum of freedom and a minimum of control from any source. Therefore, I think that it would be a mistake to attempt to control their activities through a Federal agency.

Of course, in view of the fact that many private institutions may be unable to finance an appreciable amount of scientific research activity after the war, it may be advisable or even necessary for such institutions to look to the federal and state governments for financial support. Our past experience in this country has shown us that it is possible for such governmental financial support to be given without being attended by stifling control, but the factual situation may be different after this war. For example, it seems to me that the high scientific standards of which quite a few state-financed institutions can be proud are attributable in no small part to the fact that up to the present time such institutions have been competing against privately endowed institutions with exceptionally high standards which were in a position to attract very outstanding scientists who felt that their efforts in state institutions were too closely controlled. If such competition is still present after the war, I can foresee many advantages and few disadvantages of federal financial support of the research activities of scientists in universities; if, however, there is no such strong competition, we must be careful lest federal financial support carries with it features of undesirable control.

Thus, I think that federal subsidy of the independent science of universities and other institutions in this country may be beneficial, and it may in fact be necessary in the years to come if we are to preserve that preeminence in science as a nation which is essential to our progress. But, unless we have the wisdom to extend support wisely, it may do much more harm than good. If federal support is to be given, strenuous efforts will be necessary to ensure that it furthers the work of the best and most brilliant scientific minds, and does not merely increase the bulk of mediocre work. And the support should be divorced from governmental control of the scientists and laboratories themselves, or it will stifle rather than expedite their true accomplishments.

The presence of a great body of highly able scientific men in this country has recently been an indispensable asset in time of danger. We must be sure that it is again present if we are again threatened, and science of the highest type flourishes best when it seeks its own objectives and pursues its own uninhibited ways. If we perpetuate in this country in the years to come a scientific atmosphere and body of men of the caliber that we now have, I will fear no threat from any source, for in time of need they will again respond, they will again direct their full energies in a patriotic effort, working under a closely unified and controlled program of the application of science in the prosecution of war, and they will thus do their full part in the protection of this country.

In conclusion, I wish to point out that there is another aspect of this whole subject of the furtherance of science. It extends beyond the mere application of the fruits of science to improve the comfort of the people, and it is on a more fundamental basis even than the safety of the country to external danger. The broad object of science is to increase the knowledge and the understanding of man. It aims at extending his grasp of the environment in which he lives, and his appreciation of the vast and intricate system of nature by which he is surrounded, from the study of the remote stars to the constitution of the smallest atom. We need science for this as well, so that as we live we may derive satisfaction by growing in knowledge.

Since after many years I have come to the realization that science flourishes to the greatest degree when it is most free, I feel strongly that, when peace comes, we should bend our efforts, not to perpetuate any of the necessary wartime controls which we have created for our defense, but rather to return the maximum of independence to our scientific institutions and our scientific men, wherever they may be located.

OBITUARY

RECENT DEATHS

Dr. Russell H. Chittenden, emeritus professor of physiological chemistry of Yale University, director of the Sheffield Scientific School for twenty-four years, died on December 26 in his eighty-eighth year.

Dr. James Henry Kimball, principal meteorologist of the U. S. Weather Bureau in New York, died on December 21. He was in his seventieth year.

Henry Levi Ward, director of the Neville Public Museum at Green Bay, Wis., previously for eighteen years director of the Milwaukee Public Museum, died on December 17 at the age of eighty years.

Dr. William H. Kelly, until his retirement two years ago chief veterinarian for New York State and veterinarian to the State Department of Agriculture, died on December 19. He was seventy-five years old.

SCIENTIFIC EVENTS

THE ENTOMOLOGICAL SOCIETY OF AMERICA

The thirty-eighth annual meeting of the Entomological Society of America was held at the Deshler-Wallick Hotel, Columbus, on December 7, 8 and 9. The program was arranged jointly by the Entomological Society of America and the American Association of Economic Entomologists which met at the same time and place. The general theme of the program was "Entomology and the War." Approximately half the program centered around the subtopic of "Medical Entomology in Wartime" and the other half on "Agricultural Entomology in Wartime." Personnel of the United States Army, the United States Navy and the U. S. Public Health Service took part and discussed the importance of medical entomology in maintaining the health of members of the armed services. The Royal Canadian Army Medical Corps was also represented.

The annual public address and the entomologists' dinner were omitted this year in order to devote all the available time to the topics of the program. Approximately 300 persons were in attendance.

Officers of the society for the year 1944 are: Clarence E. Mickel, University of Minnesota, St. Paul, *President;* Roger C. Smith, Kansas State College, Manhattan, *First Vice-president;* W. J. Brown, Entomological Branch, Department of Agriculture, Ottawa, *Second Vice-president;* and Herbert H. Ross, Illinois State Natural History Survey, Urbana, *Secretary-Treasurer.*

THE AMERICAN SOCIETY OF TROPICAL MEDICINE

The thirty-ninth annual meeting of the American Society of Tropical Medicine was held in Cincinnati on November 16, 17 and 18. The society met as the guest of the Southern Medical Association and conjointly with the American Academy of Tropical Medicine and the National Malaria Society. Thirty-eight scientific papers were presented.

The eighth Charles Franklin Craig Lecture was given by Colonel George C. Callender, of the Army Medical Center, Washington, D. C.

There was a symposium on War and Post-War Tropical Medicine, with Dr. L. T. Coggeshall, of the University of Michigan, presiding. Those participating included Alfred R. Crawford, Brooklyn, N. Y.; Drs. Henry E. Meleney, New York; George W. Hunter, III, Washington; A. C. Reed, San Francisco; Robert W. Huntington, Jr., San Diego; Robert L. Usinger, Savannah; Charles E. Williams, New Orleans, and W. A. Sawyer, New York, N. Y.

The president's address by Dr. N. Paul Hudson, entitled "A Broader Perspective for Bacteriology," was given at the annual luncheon. Following the address, ceremonies commemorating the fortieth anniversary of the society were held. A silver vase was presented to the editor of the *Journal* of the society, Colonel Charles F. Craig, in appreciation of his outstanding service. Dr. E. C. Faust then presented a paper entitled "The American Society of Tropical Medicine: A Biographical Sketch of the First Forty Years."

The society, joined by members of the American Academy of Tropical Medicine and representatives of the American Foundation of Tropical Medicine, met in special session to consider the responsibilities and opportunities of service in tropical medicine in the present war emergency and in the immediate future. It was proposed that the society suggest to suitable organizations the need for education and research in the field of tropical medicine, especially as pertains to civilian physicians in the post-war period.

Dr. Norman H. Topping, of the National Institute of Health, was presented with the Bailey K. Ashford award "for outstanding work in the field of tropical medicine."

Hospitality group sessions were held on November 16 and 17. At the first session, a brief discussion was presented by Lieutenant Colonel Thomas T. Mackie on "Reciprocal Inter-American Relationship." At the second session, Dr. E. Harold Hinman described the work of the Department of Inter-American Affairs in Latin America with especial reference to Venezuela.

The attendance at all sessions of the thirty-ninth annual meeting was the largest in the history of the society.

THE NEW YORK ACADEMY OF SCIENCES

THE one hundred and twenty-sixth annual meeting of the New York Academy of Sciences was held on December 15. Dr. Horace W. Stunkard, of New York University, delivered the address of the retiring president. His subject was "How do Tapeworms of Herbivorous Animals Complete Their Life Cycles?" Vilhjalmur Stefansson spoke on "The Arctic Mediterranean." As already announced in SCIENCE, Dr. Duncan A. MacInnes, a member of the Rockefeller Institute for Medical Research, was elected president of the academy.

Honorary life members were elected as follows: Professor Alexander Fleming, of the University of London and the Royal College of Surgeons, discoverer of penicillin; Sir Frederick Gowland Hopkins, of the University of Cambridge; Professor The Svedberg, head of the Institute of Physical Chemistry, and Professor Arne Tiselius, biochemist, both of the University of Uppsala; Dr. Oswald T. Avery, bacteriologist, a member of the Rockefeller Institute, and Dr. Alfred L. Kroeber, director of the Museum of Anthropology of the University of California.

A. Cressy Morrison prizes of $200 each for papers selected from eight submitted in competition were awarded to Dr. William Augustus Ritchie, archeologist of the Museum of Arts and Sciences at Rochester, N. Y., for his study of "aboriginal cultures in New York State prior to the dominion of the Iroquois tribes"; and to Dr. Arnold Grobman, of the University of Rochester, for his paper on the "Distribution of Salamanders of the Genus Plethodon in the Eastern United States and Canada."

THE INSTITUTE OF RADIO ENGINEERS

THE Institute of Radio Engineers will hold its 1944 winter technical meeting at the Hotel Commodore, New York City, on Friday and Saturday, January 28 and 29.

Hubert M. Turner, associate professor of electrical engineering at Yale University, has been elected president of the institute. He succeeds Dr. Lynde P. Wheeler, of the Federal Communications Commission.

The meeting will be devoted to the domestic, international and war aspects of radio and electronic engineering. In addition to technical papers, the program will contain several features, including participating activities by the Federal Communications Commission, a display of captured enemy radio equipment and a discussion on the newly formed Radio Technical Planning Board.

Arrangements have been made with the American Institute of Electrical Engineers for a joint evening meeting on Thursday, January 27, to be held in the auditorium of the Engineering Societies Building. Major General R. B. Colton, of the Signal Corps, will talk about enemy communication equipment and will display some of the captured apparatus. This equipment will be at the Hotel Commodore on Friday afternoon, January 28.

The American Institute of Electrical Engineers is holding its technical meeting during the week of January 24, and, for the convenience of members of the Institute of Radio Engineers who desire to attend, their papers will be concentrated during the afternoon session of January 27.

Each year the Institute of Radio Engineers recognizes outstanding achievements in the field of radio communication by the bestowal of two awards. One recognizes, in general, an extensive service over a period of years, while the other is usually conferred for a more recent contribution.

The Institute Medal of Honor is given in recognition of distinguished service in radio communication. It is awarded to one who has been responsible for an important advance in the science or art of radio communication. This advancement may be a single development or it may be a series of developments which in the aggregate have resulted in substantial improvements in radio communication.

The Morris Liebmann Memorial Prize, to perpetuate the memory of the late Colonel Morris N. Liebmann, is made possible through the generosity of E. J. Simon, a fellow of the institute. The award consists of the income from a gift of $10,000, and is not a stated amount, as it is the interest from the securities in which the principal is invested. The recipient is a member of the institute and has made public during the recent past an important contribution to radio communications.

At this meeting the 1943 Medal of Honor will be presented to Haraden Pratt and the 1943 Morris Liebmann Memorial Prize to W. L. Barrow.

THE FIFTIETH ANNIVERSARY OF THE ARMY MEDICAL SCHOOL

THE Army Medical School, founded in 1893 by Surgeon General George M. Sternberg, marked its fiftieth anniversary at the graduation exercises of the sixteenth class in military and tropical medicine on December 18. Major General Shelley U. Marietta introduced Major General Norman T. Kirk, the Surgeon General of the Army, who gave the address. Certificates were presented to the class of one hundred and twenty-four by Colonel Richard P. Strong, director of tropical medicine of the school, assisted by Lieutenant Colonel Thomas T. Mackie, the executive officer of the course. Graduates of this class included officers of the United States, Canadian and Peruvian armies and officers of state health departments.

Colonel G. R. Callender, director of the Army Medical School, presided. A simple ceremony commemorating the fiftieth anniversary honored Colonel Deane C. Howard, U. S. A., retired, who ranked No. 1 in the first class to graduate. Members of the faculty signing this diploma were Assistant Surgeon General G. H. Alden, first officer to command the school; W. H. Forwood and John S. Billings, deputy surgeons general; Charles Smart and Walter Reed, surgeons, and J. M. Cabell, assistant surgeon. Colonel Howard has had a distinguished career in the Medical Corps of the Army and was the chief of the Division of Sanitation in the Office of the Surgeon General in World War I. It was announced that a brochure covering the history of the school is being prepared.

OFFICERS OF THE AMERICAN CHEMICAL SOCIETY

Dr. Carl Shipp Marvel, professor of organic chemistry at the University of Illinois, has been elected president of the American Chemical Society for 1945. He will take office as president-elect on January 1, when Dr. Thomas Midgley, Jr., vice-president of the Ethyl Corporation, becomes president, succeeding Dr. Per K. Frolich, director of the Chemical Division of the Esso Laboratories of the Standard Oil Development Company, Elizabeth, N. J. The new president-elect was chosen by the council from four nominees receiving the largest number of votes in a national mail ballot of the approximately 40,000 members of the society.

Dr. Robert E. Wilson, of New York, president of the Pan American Petroleum and Transport Company, and Professor Roger Adams, head of the department of chemistry of the University of Illinois, were elected directors of the society. Dr. Ernest H. Volwiler, of Abbott Laboratories, Chicago, was named director at large.

The following councilors at large were chosen: Dr. Henry B. Hass, Purdue University; Dr. Joel H. Hildebrand, University of California; Dr. Gustav E. F. Lundell, National Bureau of Standards, Washington, D. C.; Dr. Linus C. Pauling, California Institute of Technology.

Dr. Marvel was recently awarded the 1944 William H. Nichols Medal of the New York Section of the American Chemical Society, one of the highest distinctions in chemical science. It is conferred annually to stimulate original research in chemistry. The presentation will be made at a meeting of the New York Section on March 10.

Dr. Marvel was cited for outstanding organic chemical contributions to the structure of vinyl polymers, used as synthetic plastics, particularly in the production of transparent aircraft pieces; as rubber substitutes and as thickening and blending agents in the chemical manufacturing industry. The citation also stressed the importance of his research in the structure of polymers of sulphur dioxide and olefines.

Dr. Marvel has carried out notable investigations in the fields of synthetic and structural organic chemistry, including the development of practical methods for preparing amino-acids, which are becoming increasingly important in the preparation of synthetic diets for intravenous feeding. Other studies have dealt with the relationship of hydrogen bonding and solubility behaviors, which forms the basis for one method of electrical refrigeration operating at low pressure, minimizing explosion hazards; the identification of organic compounds; the effect of structure in hexaarylethanes; the synthesis and rearrangement of polyines and polyynes and the organo-metallic compounds.

AWARD OF THE EDISON MEDAL TO DR. VANNEVAR BUSH

Dr. Vannevar Bush, president of the Carnegie Institution of Washington and director of the Office of Scientific Research and Development of the Office of Emergency Management, Washington, D. C., has been awarded the Edison Medal for 1943 of the American Institute of Electrical Engineers. The award goes to Dr. Bush "for his contribution to the advancement of electrical engineering, particularly through the development of new applications of mathematics to engineering problems, and for his eminent service to the Nation in guiding the war research program." The medal will be presented on January 26 at a general session of the winter technical meeting of the institute in the Engineering Societies Building, New York, N. Y.

The Edison Medal was founded by associates and friends of Thomas A. Edison and is awarded annually for "meritorious achievement in electrical science, electrical engineering or the electrical arts" by a committee of the American Institute of Electrical Engineers.

Dr. Bush joined the faculty of the Massachusetts Institute of Technology in 1919 as associate professor of electric power transmission, and became professor in 1923. He was appointed vice-president and dean of the school of engineering, Massachusetts Institute of Technology, in 1932. He has been president of the Carnegie Institution of Washington since 1939. In 1942 he was appointed chairman of the joint committee on new weapons and equipment of the joint U. S. chiefs of staff, and is a member and former chairman of the National Advisory Committee for Aeronautics.

Dr. Bush is known for his development of mathematical analyzing instruments for solving complex equations in science and engineering. The most notable of these is the differential analyzer, which greatly increases the range of engineering calculations in the field of differential equations.

SCIENTIFIC NOTES AND NEWS

At the December convocation of the University of Pennsylvania, the doctorate of laws was conferred on Dr. Edwin G. Conklin, professor emeritus of biology at Princeton University and president of the American Philosophical Society. The doctorate of science was conferred on Brigadier General James S. Simmons, chief of the division of preventive medicine of the Office of the Surgeon General.

Dr. Ludvig Hektoen, executive director of the National Advisory Cancer Council and chairman of the Chicago Cancer Committee since its organization in 1941, has been reelected chairman.

The council of the British Institution of Naval Architects has conferred honorary membership on Thomas Henry Havelock, F.R.S., professor of mathematics and head of the department at King's College, Newcastle, in recognition of his work on hydrodynamics and its application to ship wave resistance.

The United Press reports that Professor Lennart von Post, the Swedish geologist, has returned an honorary doctor's degree awarded to him two years ago by the University of Königsberg as a gesture of protest against Nazi tactics in Norway.

Dr. Emma Perry Carr, head of the department of chemistry at Mount Holyoke College, has been appointed to a visiting professorship at the Institute of Chemistry of the University of Mexico during the months of January and February. The invitation to collaborate with leading Mexican chemists on a research project was extended through the Cultural Relations Division of the State Department.

Dr. C. E. Clark, assistant professor of mathematics at the Bradley Polytechnic Institute, has been appointed to an associate professorship at Emory University.

Dr. Sidney W. Fox, research chemist with the F. E. Booth Company, Albany, Calif., has become assistant professor of chemistry and chemist in the sub-section of plant chemistry of the Iowa Agricultural Experiment Station.

Dr. Charles M. Breder, director of the New York Aquarium, until its closure and its transference to the New York Zoological Park on October 4, 1941, has been appointed curator of the department of fishes of the American Museum of Natural History. Since 1926 he has served as research associate in ichthyology at the museum. Dr. Breder served the New York Aquarium and the New York Zoological Society for twenty-two years, having been made director of the aquarium in 1937. Christopher W. Coates, a member of the staff of the aquarium, has been appointed curator of fishes at the Zoological Park. Dr. Myron Gordon, also a member of the staff of the aquarium, has been made assistant curator.

Chemical and Engineering News reports that Dr. John D. Clark, head of the department of chemistry of the University of New Mexico, has leave of absence to become associated with the Institute of Chemistry of the National University of Mexico, Tacuba. He will direct research, teach and conduct a seminar at the Benjamin Franklin Library and will be an employee of the Department of State.

C. L. Warwick, secretary-treasurer of the American Society for Testing Materials, has resigned as chief of the Materials Branch of the War Production Board in order to give more time to the work of the society. He plans, however, to devote half his time as consultant to the conservation division of the board. He will continue as administrator of the National Emergency Steel Specifications Project, and he will be chairman for the division of the advisory committee on conservation in construction.

Dr. H. L. Cochran, from 1935 to 1943 associate horticulturist in charge at the Georgia Agricultural Experiment Station, has been appointed horticulturist in charge of the production of raw products for Pomona Products Company of Griffin, Ga. He will be responsible for research on canning crops.

Dr. Sidney Weinhouse, of the University of Chicago, has become associated with the Houdry Laboratories of the Catalytic Development Corporation of Marcus Hook, Pa.

Dr. W. H. Stark, superintendent of the Butyl Alcohol Plant of Asociación Azucarera Cooperativa Lafayette, Arroyo, Puerto Rico, has resigned to become director of research with Joseph E. Seagram and

Sons, Inc., Louisville, Ky. He expects to take up his new work by January 1.

DR. GEORGE L. KREEZER, assistant professor at Cornell University, has received leave of absence to join the staff of the radiation laboratory of the Massachusetts Institute of Technology.

DR. HELGI JOHNSON, associate professor of geology at Rutgers University, recently returned from Newfoundland, where he carried on strategic mineral and geological surveys for the Government of Newfoundland in an attempt to alleviate the shortage of important war materials.

DR. WILLIAM MCDOWELL HAMMON, assistant professor of epidemiology at the School of Medicine of the University of California, chairman of the curriculum for tropical medicine, has returned to the university from a leave of absence spent in studying tropical medicine in Costa Rica, Panama and Guatemala.

FOUR members of the department of geology of the University of California at Los Angeles have leave of absence to assist the U. S. Geological Survey in its search for strategic minerals needed for the war effort. Professor James Gilluly is engaged in an investigation of copper resources; Dr. M. N. Bramlette is helping in the oil exploration program, and Dr. Cordell Durrell is conducting a search for optical quartz and calcite. Dr. Wm. C. Putnam is attached to the Washington offices of the survey. In addition fifteen graduates of the department are participating in the work. Headquarters have been set up at the university for work on the oil problems of California under the direction of Dr. W. P. Woodring, geologist of the survey.

ACCORDING to the *Alumni Bulletin* of Harvard University, a medical expedition organized by the department of tropical medicine of the Harvard Medical School and the School of Public Health, in collaboration with the American Foundation for Tropical Medicine, has flown to Liberia to study the spread and control of African sleeping sickness. The expedition will remain in the field for at least six months to make a study of the tsetse fly. Dr. Joseph C. Bequaert, assistant professor of comparative pathology and tropical medicine and associate curator of insects at the Museum of Comparative Zoology, will study the fly. Dr. David Weinman, instructor in comparative pathology and tropical medicine, will investigate the trypanosome, causative agent of the disease, and will attempt to develop new methods of diagnosis and control. Dr. Everett P. Veatch, of Pasadena, Texas, medical officer on the Firestone rubber plantations, will concern himself with the treatment of the disease by accepted therapeutic procedures and will cooperate in assaying new chemotherapeutic agents.

DURING October and November Dr. H. S. Jennings, emeritus professor of zoology of the Johns Hopkins University, gave at Indiana University the Patton Foundation lectures. His subject was "Problems of Life, Age and Death in One-Cell Animals."

THE eighth Charles Franklin Craig Lecture of the American Society of Tropical Medicine was delivered at the meeting of the society in Cincinnati on November 16 by Colonel Geo. R. Callender, M. C., director of the Army Medical School. The lecture was entitled "The Diarrheal Diseases."

DR. EDWIN G. CONKLIN, professor emeritus of biology of Princeton University, will make an address entitled "Ends as Well as Means in Life and Evolution" at a joint meeting of the Section of Biology and the Section of Psychology of the New York Academy of Sciences, to be held on January 17 at 8 o'clock P.M. at the American Museum of Natural History.

DR. ESTHER ROSENCRANTZ, associate professor emeritus of the University of California, on November 18 gave an address on "Sir William Osler" before a combined meeting of the Los Angeles County Medical Association and the Barlow Society for the History of Medicine. Many rare items from the Osler collection in the Crummer Library, combined with items from the Los Angeles Medical Library, made a large and interesting Osler collection, which was exhibited at the meeting. Dr. George Dock, who was one of Dr. Osler's colleagues during the Pennsylvania period, gave an account of a journey that he had made with Dr. Osler in search of rare books.

DR. HERBERT C. CLARK, director of the Gorgas Memorial Laboratory in Panama, who was invited by the National Research Council to visit medical schools throughout the United States, recently gave a series of lectures at the School of Medicine of the University of California at San Francisco.

THE University of Rochester will begin a weekly radio series on January 1, entitled "Time for Science." The programs will be given in cooperation with the magazine *Time* and the Stromberg-Carlson Station WHAM, of Rochester, N. Y. They will present "a realistic interpretation of the effects of scientific advances on everyday living." Dr. Gerald Wendt, science editor of *Time*, will direct the broadcasts, which will be on Saturdays from 7:30 to 8 o'clock P.M.

ACCORDING to the *Journal* of the American Medical Association, the board of trustees of the Cleveland Clinic Foundation has given a fund of $50,000 to the School of Medicine of Western Reserve University, the income to be devoted to surgical fellowships for accredited postgraduate students chosen by the faculty of the School of Medicine. The fund is named for Drs. Frank E. Bunts, George Crile and William E. Lower, who founded the clinic in 1921.

The department of pharmacology of the College of Medicine of Wayne University is the recipient of a grant of $6,000 provided by Frederick Stearns and Company for a two-year study of the pharmacological actions of methyl cellulose.

A research fund to finance studies of diseases of the mouth has been established at the College of Dentistry of New York University, of which Dr. Allen T. Newman is dean. The contributors include graduates of dental colleges here and abroad who have taken postgraduate work in periodontia at New York University and who wish to further that branch of dentistry. Dr. S. M. Robbins, of Cleveland, is chairman of the fund committee. The research will be under the direction of Professor Samuel Charles Miller. Studies of the efficacy of various dentifrices, causes of mouth diseases and an inquiry into the incidence of trench mouth will be undertaken.

Chemical and Engineering News reports that officials of the War Production Board have indicated that production of penicillin will be multiplied fifty-five times by March 1, and that the price will again be substantially lowered. Nineteen companies are now in production, but relatively little of the full capacity will be available until early in 1944. The volume of production is still a secret, but ultimately authorizations granted by WPB will result in quantities ranging from 400,000,000 units per month from some smaller laboratories to 20,000,000,000 from large chemical producers.

The Atlas Powder Company has established a central research laboratory near Wilmington, Del., for expansion of research work for the war programs. Dr. R. S. Rose, Jr., director of the Atlas laboratory at Reynolds, Pa., will be placed at the head of the new central laboratory, the first unit of which is nearing completion. The new laboratory will be devoted chiefly to the development of organic compounds for industrial uses.

The United States Steel Corporation has announced that its subsidiary, the Oliver Iron Mining Company, plans to establish an iron-ore research laboratory at Duluth, Minn., to enable it to continue its work on the improvement of the Lake Superior district iron ores.

A telephone message sent from Stockholm to *The New York Times* on December 11 reports that the Germans in Denmark have confiscated the Institute for Theoretical Research in Physics, the center for atomic research which was directed by Professor Niels Bohr until his recent escape to Great Britain. Dr. Boeggild and Herr Olsen, his chief assistant, who with their families live at the institute, were arrested and taken to a prison in Copenhagen. After the confiscation the dean of the University of Copenhagen was ordered to sign a letter agreeing to the requisition.

A United Press dispatch states that the Uruguayan Government has accepted a $500,000 gift from the U. S. Office of Coordination of Inter-American Affairs to be devoted to sanitation work and health measures. Similar gifts have been made to other Latin-American countries out of a special fund in the coordinator's office that is disbursed not as a loan but as an outright gift.

DISCUSSION

GIGANTIC DRYING CRACKS IN ANIMAS VALLEY, NEW MEXICO[1]

Some years ago there was brought to my attention a strange-looking polygonal pattern resembling drying cracks that appeared on aerial photographs of the playa of Animas Valley in southwestern New Mexico. Estimates made from the photographs of the probable size of the polygons gave such surprisingly large results as to raise doubt that they could be drying cracks. The writer requested the Army Air Force to photograph the area to provide additional material for study. This they did most effectively and kindly furnished an abundant series of vertical and oblique pictures. It was evident from these pictures that the pattern was not transient and it was inferred that the dark boundaries surrounding the light-colored polygons must be some very substantial feature upon the surface of the playa.

Subsequently the writer made three brief, but in time, widely spaced (1937–1941) examinations of the surface of the playa where the pictures indicated well-developed patterns. The first attempt proved disappointing and the investigation was partly hampered by a sheet of water from recent rains which then covered the playa. Nothing remotely resembling the striking pattern seen on the aerial photographs could be found on the playa at that time. The second visit proved more fruitful. By precisely locating a position on the ground with reference to its counterpart on the picture a faint trace was discovered which when followed through proved to be the margin of a polygon. The polygons thus identified were of enormous size averaging 80 to 90 feet in diameter. An uninformed person walking upon the playa would never suspect their presence; the only physical mark upon the surface is a broad faint depression more or less straight and trench-like, averaging 3 feet wide and perhaps an inch or more deep in the middle. Each side of a polygon is a line of fracture and fill which could not be recognized from the air were it not for a concentration of vegetation along these faint grooves. Here, either because of better-growing conditions or the more abundant lodgment of seeds, the plants *Suaeda fruticosa* Forsk., with fleshy leaves of a purplish color, and *Atriplex acanthocarpa* (Torr.) Wat., having fuzzy white leaves and bur-like fruits, are concentrated in greater numbers than upon the areas of the polygons and thus form the black borders which are so effective in outlining the polygons. Both plants are bushy and grow about a foot high. This geologic feature might have remained unnoticed were it not for the striking pattern made by the plants as seen from the air.

---

[1] Published by permission of the Director, U. S. Geological Survey.

The year 1934 was one of extreme but brief drought in southern New Mexico. Inquiry disclosed that at least one resident of Animas Valley had remembered seeing that year open fractures on the parched playa. His recollection was that the openings were narrow but may have been two or three feet deep. They were subsequently filled by collapse and inwash of surface material.

The pattern is probably old, and the ground undoubtedly has suffered repeated opening and filling with every severe drought. But why these polygons have formed on such a grand scale is a point of interest which will be enlarged upon at a more propitious time.

WALTER B. LANG

U. S. GEOLOGICAL SURVEY

POLLEN RECORD OF CANADIAN SPRUCE AND FIR FROM TEXAS BOG

A PRELIMINARY pollen analysis of the deep peat deposit (22 feet) in Patschke Bog, Lee County, Texas, gave very significant records on former ranges of boreal conifers and Castanea in North America.

Patschke Bog is an old lake, perhaps of the meander type, now filled completely with peat, which rests on fine reddish sand. The peat is extremely black and consists chiefly of finely divided wood fragments. The preliminary pollen study indicates a history of the vegetation showing the following changes in composition: Spruce-pine-oak-grasses, to oak-grasses, to grasses, to alder, to chestnut-alder, to chestnut-oak-grasses, to oak-grasses. The most significant discovery is a record of upward to 5 per cent. of Canadian spruce and fir pollen in the lower five foot-levels. Castanea attained a pollen representation of 33 per cent. at the 8-foot level, and 30 per cent. at the 6-foot level.

This pollen record shows former distribution of Castanea to have been at least one hundred miles westward of the present range limits, and of spruce and fir approximately 800 miles southward of Bacon's swamp, Indiana, the present southernmost profile showing the former range of these genera.

It seems probable that the hypothetical lake in Texas was occasioned by the blocking of a tributary to Yegua Creek. Abundant seep springs now feed the bog with water from under the adjacent hill slope.

The Patschke Bog is located in the Carrizo formation, the lowest member of the Claiborne group, near the middle of the Eocene system. The mineral content consists of about nine tenths medium-grained sands and one tenth sandy clay. Strata of impervious bluish-grey sandy shale occur at intervals, and, where erosion has exposed them, these result in seep lines of generally quite constant function, even during intense drought periods of several years' duration.

The topography is rolling, and the region is covered by a forest of which the dominants are post-oak, blackjack-oak and Buckley's hickory.

The bog itself was originally covered by a dense growth of *Ilex vomitoria* Ait., *Myrica cerifera* L., and *Quercus nigra* L., with *Erianthus saccharoides* Michx., Panicum spp., *Andropogon glomeratus* (Walt.) BSP., many species of sedges, *Osmunda cinnamomea* L., *O. regalis* L., *Anchistea virginica* (L.) Presl., Lycopodium sp., *Sphagnum subsecundum* Nees., *Rhexia mariana* L., *Pogonia ophioglossoides* (L.) Ker. as representative of the herbaceous flora. *Nyssa sylvatica* Marsh and *Ilex opaca* Ait. reach their southwestern limits along the margins; while the only collection of *Marchantia polymorpha* L. on record for Texas was made from a burned area in the vicinity.

J. E. POTZGER

BUTLER UNIVERSITY

B. C. THARP

UNIVERSITY OF TEXAS

A FORGOTTEN FACTOR IN CARDIAC PHYSIOLOGY

As the result of experience in the devising and use of mechanical hearts,[1] quite naturally my attention has been focused on the mechanical properties of the physiological model. One of these has been utterly impossible to duplicate and, as the efficiency of the machine depends largely on this factor, its consideration becomes of prime interest.

---

[1] O. S. Gibbs, *Jour. of Pharmacol. and Exp. Therap.*, 35: 197, 1930; *ibid.*, 49: 181, 1933.

The function to which I refer is the amazing ability of the heart to handle large, variable streams through markedly angular passages, at vastly different pressures and rates varying from zero to high speed, without provoking therein measurable eddies. Quite an elementary knowledge of engineering teaches us that the onset of eddies in either inlet or outlet ducts is associated with a material drop in efficiency. As the velocities increase, the production of eddies may be so great that finally they themselves may put a top level at which the system may function. Moreover, there are two different ways in which this may occur. On a low pressure induction system, the top rate of the entry stream may be easily and finally limited, while on the high pressure outflow side, the effects may also be similar where limited power is available or, alternatively, markedly increase the energy consumption per unit of flow.

In the living heart, eddies on the very low pressure flow side could very easily cause obstruction leading to acute or chronic venous congestion. On the outflow sides, the development of such eddies would be most importantly connected with a limitation of the total output, both immediately and secondarily, by the onset of unusual cardiac fatigue.

There seems little doubt that this function is associated with at least three factors, namely, the curious arrangements of the muscular bundles; the pattern of the nervous discharge; and the properties of the blood itself. It is also conceivable that the odd lining of the ventricles may have a damping effect on eddy formation. Moreover, it seems highly probable that this function is not entirely located in the heart itself, but is also carried out in the main vessels, especially the arteries where eddies would very greatly increase internal friction.

As eddies are readily discernible by stethoscope or other devices, their onset has many clinical notations. Those that are not occasioned by gross physical damage and tend to be variable in character are called haemic or organic murmurs. That changes in the blood may cause such eddies is known, especially by certain anemias, but it has not been generally recognized that their normal absence is due to a remarkable cardiac function which may itself become disturbed. Consequently, its full significance both in diagnosis and prognosis has been overlooked. Especially might attention be directed to the fact that increase in the loudness of murmurs by reason of increased work is a clear sign that the efficiency of the heart is materially decreased for such higher loading. Eddy formation in the large vessels would not be heard easily, as they are too deeply situated, but, by effectively decreasing the available flow space, they will load the heart with useless counter-friction work. The markedly decreased ability to compensate for loading by some arterio-sclerotics, in the absence of other obvious causes, may be such an example. The importance of eddies in flow systems is very well appreciated in engineering, including electrical, and it seems worth while to recall this neglected factor to students of the circulation, since it has yet to be incorporated in the standard works.

O. S. Gibbs

Memphis, Tenn.

A CATALOGUE OF INSECTICIDES AND FUNGICIDES

For the past year we have been engaged in surveying the literature and cataloguing all materials which have been tested for insecticidal or fungicidal properties. In our opinion such a compilation will be valuable to research workers and students in the fields of agricultural chemistry, economic entomology and plant pathology, particularly since it will insure a minimum of duplication in any search for new materials. Apparently no catalogue of this nature has been prepared up to the present time.

Our search so far has yielded over 500 literature citations, from which approximately 5,000 individual insecticidal and fungicidal materials have been catalogued. It is obvious that the usefulness of such a catalogue will depend upon its completeness. While we have made every effort to cover the literature completely, there are undoubtedly journal articles, bulletins and other less widely circulated publications which have been overlooked.

In this connection, therefore, we are appealing to all workers in the fields mentioned to supply the undersigned with any unpublished data, reprints or literature citations dealing with insecticidal or fungicidal tests on specific materials, so that all such materials may be included in this catalogue. Particularly we would welcome lists of materials tested by industrial research laboratories, even though the results disclosed may be of a negative nature.

Information should include the name of the chemical compound, its formula, the name of the test organism and a general statement of toxicity. In the case of plant products, the scientific name as well as the portion of the plant used for the test should be included.

It is our intention to prepare this catalogue for publication as soon as possible. Because of the size of the undertaking, it may not be available for wide distribution, but each *bona fide* contributor will be assured of a copy. We shall be very grateful for any comments or suggestion.

Donald E. H. Frear

Department of Agricultural
and Biological Chemistry,
The Pennsylvania State College

THE GIANT SEQUOIA

Apropos the current discussion in Science of taxonomists concerning the generic segregation and proper generic name of our western Sequoia they might reasonably be asked to shed some light on the following: Presl, in describing certain fossil cones from Bohemia, had what are undoubtedly the fossil cones of Sequoia. To these he gave the generic name Steinhauera in 1838, or nearly a quarter of a century before our western "big tree" was named. The citation is Presl in Sternberg's "Flora der Vorwelt," Band 2, Heft 8, p. 202, published at Prague. Sometimes it reminds one of the old printing adage that a compositor should follow copy even if it blew out of the window of the composing room.

Edward W. Berry
The Johns Hopkins University

SCIENTIFIC BOOKS

ORGANIC CHEMISTRY

Organic Chemistry. By C. W. Porter and T. D. Stewart. 6×9 in. 577 pp. Bound in dark blue cloth, with cover lettering in red. The Athenaeum Press. Boston, New York, etc.: Ginn and Company. 1943. $4.00.

As the authors explain in their preface, this book is an outgrowth and further development of their previous text, "The Carbon Compounds," which was used by them for many years in the University of California as an elementary outline of the subject and passed through a number of revisions. Organic chemistry has expanded recently so rapidly and in so many important directions that they decided to write an entirely new book rather than to prepare a further revision of the older one. The result is an excellent one-year elementary course, which gives a good bird's-eye view of the field as a whole, discusses clearly and competently fundamental concepts and theories in the light of our present knowledge, and the important contributions of organic chemistry to our understanding of biological processes and to the rapid expansion of chemical industries. The authors emphasize throughout the book the rapidly growing correlation of organic with inorganic and physical chemistry.

The book can be used not only for a full-year course in the subject, but also, as is the case at the University of California, for a half-year sophomore course taken by students in chemistry, agriculture, medicine, dentistry and home economics, by the omission of certain portions of the text.

The arrangement of the material follows in the main the usual lines of aliphatic, alicyclic, aromatic and heterocyclic chemistry, except that "Proteins and Amino Acids" and "Optical Isomerism" are placed between the chapter on "Aromatic Acids and their Derivatives" and that on "Natural and Synthetic Dyes." The "Terpenes" follow the "Heterocyclic Compounds," as do the "Sterols" also, the latter being grouped with the "Vitamins and Hormones."

One of the features which appeals strongly to this reviewer is the amount of space devoted to the hydrocarbons, particularly those of the aliphatic group (50 pp.), for, after all, the hydrocarbons constitute the steel framework upon which the whole vast, multifarious and intricate structures of organic compounds are erected. Further, the chemical developments of the last few years have already ushered in an era of aliphatic chemistry, which seems destined to rival or surpass the great era of aromatic chemistry of recent decades. Fifteen years ago, as reported recently by Dr. H. B. McClure, only about a dozen aliphatic compounds were manufactured on a commercial scale. To-day, the Carbide and Carbon Chemicals Corporation alone is shipping at least 160 different ones, approximately 40 of which require tank car transportation.

A generalized preview of the field is provided in the introductory chapter and is followed by 25 chapters covering the major classes of organic compounds. Under the heading of "Supplementary Notes," further discussions are given of "Acids and Bases," "Catalysis by Acids and Bases," "Chemical Reactivity" and "Asymmetric Change." An appendix deals with the determination of formulas from the analytical results, of "Molecular Weights" from the properties of gases or of solutions, with "Vapor Pressure," "Boiling Point and Freezing Point," "Osmotic Pressure," "Bond Distances" and "Atomic Radii." A separate section (43 pp.) is devoted to "Questions and Problems," so arranged as to accompany the individual chapters of the text, and the volume closes with a good general index.

The book is heartily recommended, not only to beginners, but also to those older organic chemists who have not had the time to familiarize themselves with the various ways in which the concepts of physical chemistry have fundamentally altered many of the older interpretations of the physical and chemical behavior of the compounds of carbon. A perusal of even the introductory chapter will make this clear.

Marston Taylor Bogert
Columbia University

THE ELECTRICAL INDUSTRY

The Rise of the Electrical Industry during the Nineteenth Century. By MALCOLM MACLAREN. Princeton University Press. 1943.

PROFESSOR MACLAREN throughout his long career as an electrical engineer in industry and as professor of electrical engineering at Princeton University has had many opportunities to associate with men who have contributed during the late nineteenth century to the development of the electrical industry. His opportunities for analyzing this development have been enhanced by his close association with the excellent collection of old instruments, including experimental models used by Joseph Henry, in the Princeton Electrical Museum.

Professor MacLaren states in his preface that he has described the development of the electrical industry in non-technical terms "in the hope that it may appeal to the general reader"; he has, however, inserted an extensive bibliography so that readers may inquire further into technical details. It is the opinion of the reviewer that the book will be most interesting to those readers who have a knowledge of the technical basis of electrical engineering. The author's brief reviews of the developments of various kinds of apparatus do not appear to be easy reading for a layman, although such brevity is to be commended from the point of view of the technically trained reader.

The early history of electricity is very briefly reviewed in the first chapter. Professor MacLaren then goes on to chapters devoted to the description of the development during the nineteenth century of communications, illumination, direct-current motors and generators, measuring instruments, direct-current distribution systems and early developments of alternating currents. These chapters present clearly and concisely the facts related to each subject. The value of the text is further extended by more than 150 reproductions of photographs of specific pieces of apparatus. Many of these illustrations are photographs of experimental apparatus and of early commercial models of batteries, motors, generators, meters, control devices and switchboards. The value of these illustrations would be greatly increased if some means had been used in each case to indicate the linear dimensions of the apparatus.

Professor MacLaren has chosen to limit his discussion to the nineteenth century. This is perhaps necessary, because an adequate history of the development during the twentieth century could not have been compressed into a single volume. His plan, however, has brought about an interesting result; the reader is conducted through a fascinating story of the development of a particular electrical device up to the beginning of this century. This is the end of the chapter, so that the reader finds himself in the same state of mind as one who reads a serial novel and is forced to wait for another month to continue a particularly exciting episode.

It is quite probable that this book will be examined with great interest by historians of science. They will find not only a series of interesting facts treated briefly and objectively in the text, but they will also be stimulated to study the bibliography which Professor MacLaren has supplied, and find there the extensive literature to which such a bibliography naturally leads.

S. REID WARREN, JR.
MOORE SCHOOL OF ELECTRICAL ENGINEERING,
UNIVERSITY OF PENNSYLVANIA

SPECIAL ARTICLES

PURIFICATION AND CHARACTER OF THE SWINE INFLUENZA VIRUS[1]

RECENTLY, there were described the purification and characterization of the influenza viruses A (PR8 strain)[2] and B (Lee strain).[3,4] The influenza virus A was found to be a lipoprotein complex of rounded or ovoid particle shape and of variable size. The average diameter of the particles, as measured from electron micrographs, was 77.6 mμ. The sedimentation diagram revealed a slightly diffuse boundary moving at a rate corresponding to the constant $S_{20^\circ} = 724 \times 10^{-13}$, from which the particle diameter was calculated to be 80 mμ. The influenza virus B was somewhat similar in constitution and in appearance in electron micrographs, but the diameter of the particles, measured from electron micrographs, was 97.3 mμ and calculated from the sedimentation constant, $S_{20^\circ} = 832 \times$

---

[1] This work was aided by the Dorothy Beard Research Fund and by a grant to Duke University from Lederle Laboratories, Inc., Pearl River, N. Y. The investigation was also supported through the Commission on Acute Respiratory Diseases, Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army, Preventive Medicine Division, Office of The Surgeon General, United States Army, and by grants from the Commonwealth Fund, the W. K. Kellogg Foundation, the John and Mary R. Markle Foundation and the International Health Division of the Rockefeller Foundation to the Board for the Investigation and Control of Influenza and Other Epidemic Diseases for the Commission on Acute Respiratory Diseases.

[2] A. R. Taylor, D. G. Sharp, D. Beard, J. W. Beard, J. H. Dingle and A. E. Feller, *Jour. Immunol.*, 47: 261, 1943.

[3] D. G. Sharp, A. R. Taylor, I. W. McLean, Jr., D. Beard, J. W. Beard, A. E. Feller and J. H. Dingle, SCIENCE, 98: 307, 1943.

[4] D. G. Sharp, A. R. Taylor, I. W. McLean, Jr., D. Beard, J. W. Beard, A. E. Feller and J. H. Dingle, *Jour. Immunol.*, in press.

10^{-13}, was 100 mμ. Similar studies on the purification and character of the swine influenza virus are reported here.

The virus employed was an egg-adapted strain of swine influenza virus obtained from Dr. John F. Enders. A 10^{-3} dilution in hormone broth of virus-infected chorio-allantoic fluid was inoculated into the chorio-allantoic cavity of chick embryos of 11 days' incubation at 37.5 C. After 42 hours' further incubation at 37 C, the chorio-allantoic fluid was drawn off and spun in the angle centrifuge at 2,000 g for 10 minutes. Purification of the virus was then effected either by adsorption on and elution from chicken red blood cells followed by ultracentrifugation or by ultracentrifugation alone.

For the former, 200 ml of fluid were adsorbed with 6 ml of washed chicken red blood cells. Agglutination was strong and rapid, as was the case with influenza virus A. The massed red cells were sedimented, separated from the supernate and washed rapidly with chilled Ringer solution. Elution was carried out at 25 C in a volume of Ringer solution one fourth that of the starting chorio-allantoic fluid, and in contrast with the conditions favorable for elution of influenza viruses A[2] and B,[3,4] 6 hours were allowed for separation of the virus from the red cells. The eluate, freed of red cells, was spun in the ultracentrifuge at 20,000 g for 1 hour. The supernate was poured from the clear gel-like pellets, which were redispersed in Ringer-calcium chloride solution,[2] adjusted to pH 7.3 (with 0.01 N NaOH) at 150 times concentration with respect to the starting fluid. The concentrate was cleared of aggregates by spinning at 5,000 g for 5 minutes.

For purification of the virus by ultracentrifugation alone, the virus-infected chorio-allantoic fluid, after angle centrifugation, was put through two cycles of alternate high (20,000 g) and low (5,000 g) speed centrifugation similar to the single cycle employed for the eluate described above.

The infectious titer of the chorio-allantoic fluid varied from $10^{-7.3}$ to $10^{-7.8}$ and the hemagglutinative titer from 1–128 to 1–256. In the adsorption-elution process from 70 to 100 per cent. of the activity were carried into the eluate. In ultracentrifugation of the eluates, 50 to 80 per cent. of the hemagglutinative activity and 20 to 50 per cent. of the infectivity were recovered in the concentrates. The yield of activity in the concentrates of ultracentrifugation alone was about the same as that obtained when adsorption, elution and ultracentrifugation were carried out. In all instances, virus activity was associated with the concentrates obtained at 20,000 g.

The final pellets obtained by either procedure were clear, gel-like and could be quickly dispersed in Ringer-calcium chloride solution to give a bluish opalescent preparation. Preparations containing 0.28 mg nitrogen per ml sedimented in the analytical ultracentrifuge with a slightly diffuse boundary and at a rate corresponding to $S_{20^{\circ}} = 662 \times 10^{-13}$. From this constant and the density, 1.18, as determined by pycnometer measurement, the particle diameter was 81.5 mμ. Analyses made both by the adsorption procedure of Svedberg and by the scale method gave comparable results.

Examinations of the purified material in the electron microscope revealed images which were for the most part nearly round but in many instances were ovoid or bean-shaped, similar in appearance to those of influenza virus B. The particles in solutions of the concentrates showed a strong tendency to aggregate, especially in material sedimented at 27,000 g, the ultracentrifugal field employed in preliminary work with this virus. In individuals clearly shown, there was an internal structure of relatively high density. Wide variations were seen in diameter. From measurements on 1,051 images, the average diameter was 78.3 mμ.

Studies with the electron microscope were made also of the various fractions obtained in the purification process. In the crude chorio-allantoic fluid there was a profusion of small particles of about 20 mμ and less diameter, which were somewhat like those seen in the instance of influenza virus A[2] and wholly unlike the relatively large particles of variable size in the chorio-allantoic fluid infected with influenza virus B.[3,4] Interspersed with the small particles there were many larger particles of a size and appearance corresponding to the virus in the purified concentrates. Small particles, comparable in numbers to those seen in chorio-allantoic fluid, were present in the fluid after adsorption, but very few particles of about 78 mμ were visible. In the eluate, four times concentrated, many more of the large virus particles were seen amidst many of the small ones carried over in the adsorption-elution process. The appearance of the supernate after ultracentrifugation resembled that of the adsorbed fluid in the presence of many small particles and very few of the large ones. The final concentrates contained but few of the small particles.

The concentrates gave positive biuret, Millon and ninhydrin reactions, negative glyoxylic acid reactions and delayed, weakly positive Molisch tests. The reaction for pentose with Bial's reagent was negative after hydrolysis of the material with 10 per cent. sulfuric acid. This result, together with a weakly positive diphenylamine reaction, indicated the presence of nucleic acid of the desoxypentose type. The specific volume by pycnometer measurement was 0.850.

Analysis of the concentrates, dialysed against distilled water, frozen and dehydrated *in vacuo* and then over P_2O_5 gave carbon 51.4, nitrogen 9.0 and phosphorous 0.87 per cent. By extraction with alcohol-ether (3–1) and reextraction of the lipids with petroleum ether,[5, 6] the lipid fraction was 24 and the non-lipid fraction 77.76 per cent. of the material. The total lipid fraction was made up of 10.64 per cent. phospholipid, 5.67 per cent. cholesterol and 7.64 per cent. neutral fat. Of the total phosphorous, 52 per cent. were found in the lipid fraction. If the remainder of the phosphorous was present in nucleic acid, the virus would contain about 4.0 per cent. nucleic acid of the desoxypentose type.

The total carbohydrate[7] (as glucose) content of the whole virus was 10 per cent. The carbohydrate, apparently firmly bound in complex form, was greatly in excess of that expected for the amount of nucleic acid present. Subtracting this value from that of the non-lipid fraction, 77.76 per cent., the probable protein content of the virus was about 67.76 per cent.

A similar finding has been encountered with influenza virus B (Lee strain), in which the total carbohydrate was 9.3 per cent.

The infectious unit of the virus when inoculated in 0.05 ml volumes in chick embryos was $10^{-12.16}$ to $10^{-13.1}$ grams with an average of $10^{-12.74}$. One concentrate, purified by adsorption, elution and centrifugation and titrated in fivefold dilutions employing 40 embryos per dilution, gave the value $10^{-13.11}$ grams; another concentrate purified by ultracentrifugation alone and titrated similarly in 40 embryos per dilution gave $10^{-12.75}$ grams. The hemagglutinative activity of the concentrates was such that $10^{-6.16}$ to $10^{-6.46}$ grams with an average of $10^{-6.29}$ grams gave the 2 plus end point.

A. R. TAYLOR
D. G. SHARP
I. W. MCLEAN, JR.[8]
DOROTHY BEARD
J. W. BEARD[9]
J. H. DINGLE[9]
A. E. FELLER[9]

DEPARTMENT OF SURGERY,
DUKE UNIVERSITY SCHOOL OF MEDICINE
AND
RESPIRATORY DISEASES COMMISSION LABORATORY
STATION HOSPITAL, SECTION 2, FORT BRAGG, N. C.

DECREASE IN LACTIC ACID CONTENT OF THE BRAIN IN POLIOMYELITIS[1]

RACKER and Kabat[2] demonstrated that anaerobic breakdown of glucose is significantly decreased in mouse brain infected with poliomyelitis virus, while oxidation of glucose by the infected tissue is apparently unimpaired. Brodie and Wortis[3] reported some determinations of the lactic acid content of brain and spinal cord in poliomyelitic monkeys. Their data indicate a decrease in lactic acid content of the brains infected with poliomyelitis as compared to normal monkey brains, although there were too few determinations to be conclusive. It therefore appeared of interest to determine the lactic acid content of the brain in mice infected with poliomyelitis.

Swiss albino mice four to six weeks of age were inoculated intracerebrally with a 10 per cent. suspension of tissue of the central nervous system from mice infected with the Lansing strain of poliomyelitis virus. When the animals showed definite paralysis, they were sacrificed by sudden immersion in a mixture of solid CO_2 and ether and left in the mixture for at least ten minutes. The brains were removed carefully using chilled instruments; the tissue was crushed and finely ground in a chilled mortar or tissue crusher and added to cold trichloroacetic acid in a tared glass-stoppered flask. The flask was reweighed and placed in an ice bath. After fifteen minutes, the solution was filtered. Lactic acid of the filtrate was determined by the Miller-Muntz method using the photoelectric colorimeter.[4] Lactic acid content of the normal mouse brain was determined by the same procedure. Three brains were pooled for each determination, giving a total wet weight of brain tissue of approximately one gram.

Data on lactic acid content of the brain in normal mice and in mice infected with the viruses of poliomyelitis and encephalitis are presented in Table I. The lactic acid content of the normal mouse brain is similar to the results reported by Stone,[5] who obtained a mean value of 18.9 mg per cent. and a range of 12–25 mg per cent. after freezing in liquid air. It is apparent that brain lactic acid is decreased in poliomyelitis, since the mean value is only 16.0 mg per cent. as compared to 20.7 mg per cent. for the normal controls, a decrease of 22.7 per cent. By use of the "t distribution,"[6] this difference has been found to be statistically significant. On the other hand, a preliminary study of brain lactic acid content in mice infected with encephalitis (3 determinations on Western equine encephalomyelitis and 2 on St. Louis encephalitis) showed no decrease from normal. A decrease in lactic acid content of the brain tissue in poliomyelitis is probably related to the decreased ability of the brain to break down glucose to lactic acid under anaerobic conditions demonstrated by Racker and Kabat.[3] That this effect of poliomyelitis may be specific and not produced by other neurotropic viruses is suggested by recent metabolic studies.[7]

---

[5] E. Kirk, *Jour. Biol. Chem.*, 106: 191, 1943.

[6] E. Kirk, I. H. Page and D. D. Van Slyke, *Jour. Biol. Chem.*, 106: 203, 1943.

[7] J. Tillmans and K. Philippi, *Biochemische Zeitschrift*, 256: 36, 1929.

[8] Fellow in virus research, Division of Medical Sciences of the National Research Council.

[9] Representing the Commission on Acute Respiratory Diseases, whose other members are Drs. T. J. Abernethy, G. F. Badger, N. L. Cressy, Captain, M. C., A. D. Langmuir, C. H. Rammelkamp and E. Strauss.

[1] Aided by a grant from the National Foundation for Infantile Paralysis. Dr. Kabat is at present with the Division of Chemotherapy, National Institute of Health, Bethesda, Md.

[2] E. Racker and H. Kabat, *Jour. Exp. Med.*, 76: 579, 1942.

[3] M. Brodie and S. B. Wortis, *Arch. Neurol. and Psychiat.*, 32: 1159, 1934.

[4] R. H. Koenemann, *Jour. Biol. Chem.*, 135: 105, 1940.

[5] W. E. Stone, *Biochem. Jour.*, 32: 1908, 1938.

TABLE 1

Lactic Acid Content of the Brain of Normal, Poliomyelitic and Encephalitic Mice*

	Normal	Poliomyelitis	Encephalitis	
			Western equine	St. Louis
	19.9	16.5	23.0	15.9
	16.9	17.9	34.0	21.0
	22.9	13.2	15.0	
	19.3	16.4		
	20.5	15.0		
	20.2	11.8		
	22.4	7.9		
	12.6	16.4		
	25.9	21.2		
	21.7	20.6		
	18.9			
	19.8			
	26.7			
	16.3			
No. of determinations	15	11	(both types) 5	
range	12.6-26.7	7.9 to 21.2	15.0-34.0	
mean	20.7	16.0	21.5	
t		3.04	0.43	

* All values in mg per 100 grams of brain tissue.

In another set of experiments, normal and poliomyelitic mice were decapitated and the heads kept at 37° C. for definite time intervals and then frozen in dry ice-ether mixtures. The progressive increase in lactic acid in the brain following decapitation is illustrated in Fig. 1. These results are preliminary, since each point on the curves represents an average of no no more than three determinations. The production of lactic acid under anaerobic conditions from substrates present in the brain tissue appears to be at least as rapid in poliomyelitis as in normal controls, with the possible exception of the period immediately following decapitation. Kerr and Ghantus[8] studied the production of lactic acid during autolysis in the dog brain and found that sugar disappears within 3 to 5 minutes and 80–85 per cent. of the glycogen is lost within 15 minutes. Even in the early stages of autolysis, however, glycogen breakdown provides a considerable portion of the lactic acid produced. Since the rate of formation of lactic acid in autolysis depends on the concentration of at least two substrates in the brain tissue, glucose and glycogen, as well as on many other factors, the experiment illustrated in Fig. 1 may not be considered evidence against a decreased anaerobic metabolism of glucose in the brain in poliomyelitis.

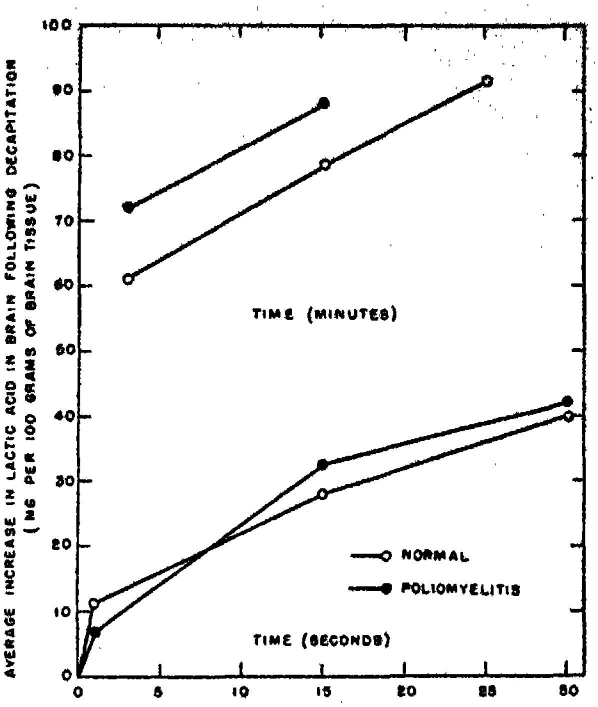


Fig. 1. Increase in lactic acid content of the brain of normal mice and of mice infected with the virus of poliomyelitis during postmortem autolysis. The abscissa for the lower curves represents seconds and for the upper curves represents minutes.

Another type of experiment is presented in Table 2. Mice were sacrificed by freezing in a dry ice-

TABLE 2

Effect on Brain Lactic Acid of Storage of Mice in Dry Ice Box

Time after death (hours)	Normal	Poliomyelitis
0	20.7*	16.0*
3	22.4	....
3.5	29.5	....
5	41.5	....
6.5	31.9	....
12	33.4	16.9
24	53.1	13.8
48	30.2	22.7
72	40.3	....
80	31.0	12.1
120	30.3	20.7
No. of determinations	10	5
range	22.4 to 53.1	12.1 to 22.7
mean	34.4	17.2
t†	5.46	0.545

* Average.
† Compared to mean of determinations on unstored brain.

---

[6] F. E. Croxton and D. J. Cowden, "Applied General Statistics," Prentice-Hall, Inc., New York, 1940.

[7] M. Nickle and H. Kabat. Unpublished observations.

[8] S. E. Kerr and M. Ghantus, *Jour. Biol. Chem.*, 117: 219, 1937.

ether mixture and then stored for various periods of time in a dry ice box before removal of the brains and analysis for lactic acid. There is a statistically significant though variable increase in lactic acid content in the stored normal brain while no significant change was noted in the stored poliomyelitic brain. This experiment requires confirmation before speculation on the mechanism would be advisable.

Summary: Lactic acid content of the brain is significantly decreased in mice infected with the virus of poliomyelitis. This appears to be additional evidence for the view that the virus may interfere in a specific manner with cell metabolism.

Herman Kabat
Dorothy Erickson
Carl Eklund
Margaret Nickle

Department of Physiology,
University of Minnesota, and
Division of Preventable Diseases,
Minnesota Department of Health

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A RAPID IRON HEMATOXYLIN TISSUE STAIN FOR ROUTINE LABORATORY USE

The *Heidenhain iron hematoxylin method for tissue staining* is one of the most important and satisfactory cytological stains for the demonstration of fine nuclear and cellular detail. Its use as a routine stain would be highly desired. However, the length and relatively difficult technique of the iron hematoxylin stain restricts this method to the more or less special, non-routine procedures. Although it is possible to stain tissues with Heidenhain iron hematoxylin in as little as one to two hours, the most satisfactory results require from twelve hours to two days (Guyer,[1] Bensley and Bensley[2]). In view of the desirability of the use of this stain routinely, we have attempted to find a suitable modification whereby the technique might be shortened considerably and made more adaptable for common laboratory use. By incorporating a single change in the usual procedure, to be described below, the time necessary for staining the tissue is shortened to even less than that entailed for Delafield's or Harris's hematoxylin stain.

The modification simply consists in fixing and mordanting the tissue simultaneously in Bouin's fixative containing one and a half grams of ferric alum (Ferric ammonium sulphate) in 100 cc of fixative. The Bouin's acts as the fixative and the ferric alum functions as the mordant. The ferric alum does not impair the excellent fixative qualities of Bouin's, while Bouin's does not interfere with the mordanting of the tissue by ferric alum. The combined fixative and mordant has no deleterious effect upon the tissue.

After removal of the tissue from the combined fixative-mordant, it is prepared for mounting and staining by following the procedure usually employed for hematoxylin stains. Either ethyl alcohol or dioxan may be used for the dehydrating agent and 0.5 per cent. hematoxylin to stain. Inasmuch as mordanting has already been accomplished during fixation, the sectioned tissue may be placed directly into the hematoxylin after passing the mounted sections from xylol to water, using either dioxan or alcohol in the intermediate steps. The tissue will overstain in from 3 to 5 minutes and destaining may be carried out as desired in 0.1 per cent. HCl (aqueous or 35 per cent. alcoholic solution). The acid destain is followed by an alkaline aqueous or alcoholic wash prepared by the addition of several cc of a saturated solution of lithium carbonate or 1 per cent. solution of sodium bicarbonate to 100 cc of water or 35 per cent. alcohol, respectively.

The modification of the accepted iron hematoxylin procedure has been used successfully on many different types of tissues and the resulting cytological picture is comparable to that observed after use of the lengthy Heidenhain iron hematoxylin method. There are, however, two cautions worthy of note: One is that although this technique is very adaptable for small pieces of tissues (5 to 6 mm cubed), larger pieces of tissue require longer fixation. This is to allow for sufficient penetration of the ferric alum to complete the mordanting process. For the smaller pieces of tissue, the combined fixative-mordanting process is completed by the time the tissue would be normally fixed when placed in the fixative alone. The second point is that in the process of staining the slides it is important that the transfer of tissue from dioxan or alcohol to the dye should be accomplished as rapidly as possible. If the tissue stays in the intermittent water wash for too long a period of time the ferric alum may be completely removed from the tissue and remordanting will be necessary.

Summary: A modification of the standard Heidenhain iron hematoxylin stain is described in which the process of fixation (in Bouin's) and mordanting (ferric alum) are executed simultaneously instead of independently. Consequently, mordanting just prior to staining is unnecessary. Staining takes from 3 to 5 minutes. This modification of the usual procedure makes for a rapid and simple stain for routine laboratory use with the resulting stain comparable to that observed after use of the accepted and lengthy Heidenhain iron hematoxylin method.

---

[1] M. F. Guyer, "Animal Micrology," University of Chicago Press, Chicago, 1936.

[2] R. R. Bensley and S. H. Bensley, "Handbook of Histological and Cytological Technique," University of Chicago Press, Chicago, 1938.

HERBERT S. KUPPERMAN
CHARLES R. NOBACK
SCHOOL OF MEDICINE OF
THE UNIVERSITY OF GEORGIA,
AUGUSTA

A MYOTOME FOR BIOPSY OF MUSCLE[1]

IN a study of the chemistry and metabolism of muscle it is desirable to have a means by which small quantities of muscle may be removed simply and frequently from patients and experimental animals. Various tissue punches and methods of aspiration biopsy have been described.[2-7] These methods are well adapted for the removal of specimens of friable tissues. They are not useful, however, in obtaining specimens of less friable tissues such as muscle. An instrument has been devised for the removal of portions of muscle, 20 to 50 milligrams in weight, without disruption of the histological structure. This quantity of muscle is sufficient for various analyses by microchemical procedures and for histological studies.

The instrument or myotome consists of an outer stainless steel tube, the distal end of which is square and provided with cutting edges (Fig. 1). A second and shorter stainless steel tube fits within the outer tube and serves as a plunger which is kept in position by a steel spring. To its distal end is attached a flexible steel blade which moves through a double slot in the wall of the outer tube. This blade, like that in the large viscerotome of Soper, Rickard and Crawford,[8] acts as a knife to sever the base of the specimen of muscle entering the instrument. An obturator fits within the lumen of the inner tube.

The myotome is used in the following manner. After sterilization of the skin and its infiltration with novocain solution, a minute stab wound is made with a sharp-pointed knife. The myotome with the obturator inserted is passed through the skin incision and through the subcutaneous tissue. Increased resistance is met when the myotome enters the muscle. At this time the obturator is withdrawn. The instrument is inserted further and directed at an angle of 60 degrees to the horizontal and in the longitudinal plane of the muscle fibers. A portion of the muscle enters the outer tube. The inner tube or plunger is then pressed down to sever its attached end. Pressure is maintained on the plunger as the myotome is withdrawn. After withdrawal the plunger is released and the obturator inserted to expel the specimen. Several specimens may be taken through a single skin incision.

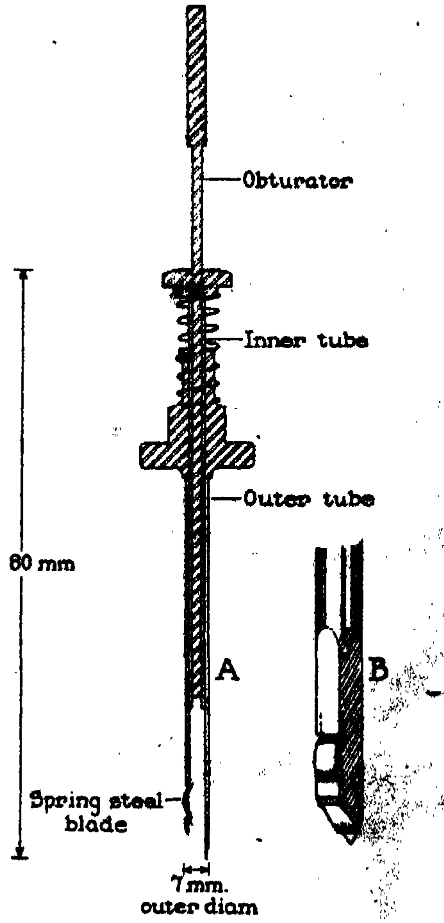


FIG. 1. A. Cross section of the myotome. B. Distal end showing the cutting edges.

ROBERT E. SHANK[9]
MEDICAL CORPS, U. S.
NAVAL RESERVE
CHARLES L. HOAGLAND
HOSPITAL OF THE ROCKEFELLER INSTITUTE
FOR MEDICAL RESEARCH,
NEW YORK, N. Y.

---

[1] The Bureau of Medicine and Surgery does not necessarily undertake to endorse views or opinions which are expressed in this paper.

[2] H. E. Martin and E. B. Ellis, *Annals of Surgery*, 92: 169, 1930.

[3] W. J. Hoffman, *Am. Jour. Cancer*, 15: 212, 1931.

[4] K. Lindblom, *Acta Radiologica*, 16: 295, 1935.

[5] C. C. Franseen, *New Eng. Jour. Med.*, 224: 1054, 1941.

[6] J. Tenopyr and I. Silverman, *Radiology*, 36: 57, 1941.

[7] M. L. Weinstein, M. Schindler and E. L. Adams, *Ann. Surg.*, 115: 880, 1942.

[8] F. L. Soper, E. R. Rickard and P. J. Crawford, *Am. Jour. Hyg.*, 19: 549, 1934.

[9] Member of the United States Navy Research Unit at the Rockefeller Hospital.

I. A. R. I.

IMPERIAL AGRICULTURAL RESEARCH
INSTITUTE LIBRARY
NEW DELHI.

Date of issue.	Date of issue.	Date of issue.
3.3.48		
8.3.48		
22.4.48		
7.6.49		
22.5.49		
1 NOV 1954		
14.8.57		
16 JUN 1969		
7.1.83 (ILL)		